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REVIEWS.

A School Text on Highway Bridge Design.

Reviewed by ALBERT WELLS BUEL.*

THE DESIGN OF HIGHWAY BRIDGES.—And the Calculation of Stresses in Bridge Trusses. By Milo S. Ketchum, M. Am. Soc. C. E., Dean of College of Engineering and Professor of Civil Engineering, University of Colorado. New York: The Engineering News Publishing Co. London, England: Archibald Constable & Co., Ltd. Cloth; 6 × 9 ins.; pp. 544; 309 illustrations, partly in the text, and 77 tables. $4 net.

A general review of this work may conveniently be introduced by a brief critical survey of the contents of its individual chapters.

Opening the book we find that 45 pages are devoted to an Introduction, and to Loads and Weights. The descriptive definitions, which largely compose the Introduction, leave much to be desired in precision and clearness, and the nomenclature here, as well as throughout the book, uses many terms in an inaccurate or provincial way. Considerable space is given to tables and diagrams of weights of steel in standard highway bridges as designed and built by three different bridge works companies. These are about the same that the estimating departments of all highway bridge companies use, but are inferior to a set that has been in use for fifteen years. No doubt they were the best available for publication. It is not clear, however, what material advantage is gained by including three sets, as the variations are not important for any purpose for which the book is intended.

The inclusion of "Live Loads for Railway Bridges," with Cooper's typical wheel loading and a number of illustrations and problems in railway bridge design, all disconnected and not correlated, goes far to make the arrangement of the book and its contents seem illogical, but, fortunately, this defect is more apparent than real.

"A brief course in the calculation of the stresses in bridge trusses" is given in the next 96 pages, following which a section of 50 pages, devoted to 24 "problems in calculation," completes Part I. This "brief course" begins with the very elements of graphical statics, not even assuming on the part of the student or reader a knowledge of the triangle of forces (on the other hand some knowledge of the calculus is presupposed). The author appears to have considerable facility in giving difficult mathematical demonstrations in a very simple and clear style, and it is therefore to be hoped that we shall have other books from his pen, treating only of the mathematical solution of engineering problems. The problems in calculation appear to have been carefully selected and arranged, and materially enhance the value of the work, especially for school use.

Part II., "The Design of Highway Bridges," is introduced by what may be termed a description of the current practice of reliable bridge companies, and 42 pages are divided into three chapters entitled "Short Span" and "High Truss" Steel Highway Bridges, and Plate Girder Bridges. With one exception all the illustrations of Plate Girder Bridges are of railway structures. Five folding plates serve to illustrate details.

The next two chapters, XIII. and XIV., occupy 59 pages, mostly devoted to extracts from specifications and tables taken from handbooks, etc. For the use of students the inclusion of this material may be desirable, but for most other purposes it is hardly in a convenient form.

Chapter XV., "The Design of Abutments and Piers," is an innovation in a book on bridges, and one that will be welcomed by many. The chapter comprises only about 40 pages, ten of which are very properly devoted to steel cylinder piers, and about an equal space to the specifications for masonry recommended by the American Railway Engineering and Maintenance of Way Association. The author has done so well with this chapter that it is a matter of regret that he has not treated the subject more in detail, giving it the attention its importance deserves. He deserves credit for departing from precedent to include it at all, and for this the users of the book should be grateful. There is no reason why substructure and abutments and piers should not be given a prominent if not a primary place in a text-book on bridge design. Possibly the reason that it has not heretofore been customary to do so is that the majority of the books on bridges have been confined to a treatment of some particular part of the subject. In fact the whole subject can hardly be done justice in one volume or by one author.

In the Chapter on "Stresses in Solid Masonry Arches" the author has succeeded in treating the elastic method in such a simple and clear way that, for the first time, it has a chance to get on speaking terms with the average engineer. This should work a great good, and forever put a stop to the perennial communications in engineering journals attacking and slandering the elastic method. But for anything more than the purely mathematical part of the problem one has to turn to the middle of the next chapter, where, sandwiched between "Stresses in Reinforced Concrete Beams and Columns" and "Culverts," there are a few unsatisfactory and in some respects misleading illustrations of reinforced-concrete arch bridges, presented without any instructive criticism or comment. In this part, also, the author illustrates (p. 385) an "8-ft. plain concrete culvert," and erroneously credits its design to Mr. Edwin Thacher, whereas it is one of a set of standard designs by the writer of this review. At another place the statement that transverse bars are placed in an arch "to resist temperature" is poorly expressed and overlooks the chief functions of transverse bars in reinforced-concrete arches.

Following a short chapter on "The Design of Timber and Combination Bridges," which would be satisfactory if it did not omit mention of the only combination bridge free from thermal stress—the Thacher truss—the author takes up "Erection, Estimates of Weights and Costs."

Erection is covered in three pages, entirely inadequately and unsatisfactorily. The notes on weight estimates and costs will be received with varying degree of approval or disapproval according to the viewpoint of the reader. The new discovery that "The rolls used in rolling sections are designed to give a section of the required weight when the rolls are new, so that sections are usually slightly heavier than the figured weights due to the wear or the spreading of the rolls," will sound strange to experienced bridge men, but it finds some explanation in a remark in the author's preface, that his knowledge was gained in "designing and contracting for highway bridges in a dozen states." The statement that estimates from stress sheets should not vary by more than 1½ to 2% from shipping weights requires to be qualified as applying only to standard spans, where the percentage of details, rivet heads and waste is very accurately known.

Part III. devotes 74 pages to "A Problem in Highway Bridge Details" and is a review of a 160-ft. Pratt truss span. This and the following 23 pages of the Appendix, in which the author offers his new specifications for Steel Highway Bridges, could have been omitted without greatly detracting from the value of the book for general use, although the author, no doubt, has found it an advantage to include this matter for the use of the students in his classes.

There are many sides to the art and business of bridge building, and it is not an easy task to judge a book fairly from the different viewpoints of all concerned, unless it is specially written for a very definite and limited purpose.

The book under review appears to have been compiled and arranged from the lecture notes, data and problems used by the author in his classes. It should therefore be primarily judged as a text-book for engineering schools. As such it seems to have valuable characteristics. But most engineering schools will probably find it too voluminous for the limited subject of highway bridges, to be preceded by a course in the design of Mill Buildings and followed by another in Railway Bridges. (The author says it "is supplementary to his 'Design of Steel Mill Buildings,' and covers the essential part of a first course in bridge design.")

It is conceded that to determine the usefulness of the work as a school text-book the opinions of men engaged in educational work will have greater value than those of a practicing engineer. But it seems that the work is also intended to meet the needs of municipal and county engineers, surveyors and all men engaged in highway bridge construction whose duties require some knowledge of design and construction, except "experienced engineers," who are almost specifically excepted. This is intended, no doubt, to mean expert bridge engineers or bridge experts.

It is natural to expect that those who have paid for their experience by long years of service in the mills and shops and in the field on erection will not place the highest estimate on experience gained from books. Possibly the time will come when there will be a royal road to a thorough knowledge of the bridge building art and "The Design of Highway Bridges" is a step in that direction. With a few exceptions, notably Chapters XV. and XVI., the only things the book contains that are not found in any one of half a dozen others are those which heretofore it has only been possible to acquire by experience in bridge work, and, preferably, with a bridge building company. If those who use the book can be brought to understand the author's statement that it "covers the essential part of a first course in bridge design," and also the limitations of purely literary knowledge of a practical subject, Professor Ketchum's work will be of inestimable value. But seemingly the author has not intended it for those who can be relied upon to have such understanding.

A very prominent bridge engineer, a few years ago, complained that there was no satisfactory text-book on bridges in existence and suggested that the writer undertake such a work. The latter, in reply, said that he only considered himself equipped to cover a small part of the field, and that such a work would be more likely to

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meet expectations if produced as the joint work of a number of competent authorities, properly coordinated and organized. An opportunity exists for some able executive, with some conception of the work involved, to associate a number of competent writers, combining experience in all branches of the subject of Framed Structures, with favorable chances of success in producing an entirely satisfactory text-book. The subject is a large one, and few men are versatile enough, combining mathematical and constructive talents in a high degree, to cover all parts of it in an authoritative manner. The very few who are properly equipped for the task, intellectually and by experience, have not been able to afford the time to do the work thoroughly. It is, at best, not a profitable field, and, generally speaking, such tasks should better be undertaken only from altruistic or educational motives.

From this point of view, therefore, too much should not be expected from the pen of any one author of a book on bridges. On the other hand, it is questionable whether any more text-books on the subject are demanded until either such a man as has been above indicated can find the time to do the work or until a collaboration of experts can be produced. It is now 36 years since Squire Whipple brought out the second edition of his enlarged and improved work entitled "An Elementary and Practical Treatise on Bridge Building," but it is a question whether a reprint of that book, with some comparatively unimportant changes to bring it up to date, would not be as well received as any recent work.

Professor Ketchum's book will, no doubt, have a large sale among certain classes interested in ordinary highway bridge problems. As the first book in many years devoted to this subject, it deserves a measure of success, at least sufficient to encourage further efforts in the same direction. It is a matter of regret that the author's treatment of the subject, in general, seems to be content with expounding current practice in ordinary highway bridge building, without making a more serious effort to elevate that practice.

The author has given substantial evidence of a high order of ability in more than one direction. A little more painstaking care in writing would make the book, in parts, easier reading, and more harmonious with his mathematical work. The typography, paper, illustrations and binding are good.

CIVIC IMPROVEMENT AND BEAUTIFICATION, CITY OF CEDAR RAPIDS, IOWA.—Report of Charles Mulford Robinson [Rochester, N. Y.] to the Mayor and City Council of Cedar Rapids. Paper; 6¼ × 9¾ ins.; pp. 13; folding and other plates.

Cedar Rapids is one of a number of American cities which is now being governed on the so-called commission plan, and it is interesting to note that one of the first acts of this commission was to call upon a man experienced in the esthetic and allied betterment of cities. Mr. Robinson found conditions at Cedar Rapids unusually satisfactory, but was nevertheless able to suggest a number of important changes. These related particularly to the provision of streets intersecting the already existing radial street system, the extension of the radial streets, the provision of additional parks and park connections and some minor improvements.

THE POLLUTION OF STREAMS BY SULPHITE PULP WASTE.—A Study of Possible Remedies. By Earle Bernard Phelps. Investigation made at the Sanitary Research Laboratory and Sewage Experiment Station of the Massachusetts Institute of Technology. Water-Supply Paper 226, U. S. Geological Survey; George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 37; one plate.

In brief space Prof. Phelps here presents an interesting study of a very important problem in stream pollution and the disposal of trade wastes. It is estimated that about 3,250,000,000 gals. of sulphite waste liquor were discharged into streams of the United States in 1906, and that this immense volume of waste contained more than 2,500,000,000 lbs. of solid matter, mostly organic. After reviewing previous studies of sulphite pulp wastes, Prof. Phelps outlines the method of making wood pulp by this process and then proceeds to state the problem involved in treating the waste liquor. Experimental investigations with the organic matter contained in the liquor are outlined, largely in chemical terms. These experiments were made in the hopes of developing commercial dyes from the substance in the wastes known as lignone.

The conclusion of the whole matter is that all processes thus far brought forward for utilizing the "immense amount of waste matter" in the sulphite pulp waste liquors have been "unsuccessful, either because there is only a limited market for the proposed product or because the suggested process is prohibitively costly." This conclusion is all the more remarkable in view of the fact that "a prize of 10,000 marks was offered in Germany in 1894 for the best method of preventing the pollution of streams by sulphite liquor, but it still remains unawarded."

MORRISON'S SPRING TABLES.—A Handbook for Engineers, Students and Draftsmen. By Egbert R. Morrison, Jun. Am. Soc. M. E. Sharon, Pa.: The Author. Cloth; 5¾ × 9¼ ins.; pp. 84. $2, net.

The formulas and tables contained in this book are intended for use in the design of springs for carrying certain loads with certain distortions. There is nothing here given relating to the design of springs for the storage of power—either motor or clock springs.

The compiler has classed helical springs made from bar less than 1/6-in. in diameter and elliptical springs of plate less than 1/16-in. in thickness as "light." One part of the book contains general and specific formulas for the deflection, length of untwisted bar, load, etc., etc., of both helical and elliptical springs. The properties of steel springs of different gage wire and plate have been computed from these formulas and tabulated. These figures are made up with a fiber stress of 80,000 lbs. per sq. in. and moduli of elasticity of 12,600,000 and 25,400,000 for helical and elliptical springs, respectively.

It should be noted that the author has kept the term "helical" in its true meaning throughout the book. In common practice true helical springs have been loosely spoken of as "spirals" creating confusion whenever it was desired to differentiate between a true spiral spring and a helix. The author will be commended on this point by those having need of his tables, even though they have to change their own definitions of different springs.

Another Book on Illuminating Engineering.

ELECTRICAL ILLUMINATING ENGINEERING.—By William Edward Barrows, Jr., Assoc. M. Am. Inst. E. E., Assistant Professor of Electrical Engineering, Armour Institute of Technology. New York: McGraw Publishing Co. Cloth; 5¼ × 8¾ ins.; pp. 216; 135 illustrations in the text. $2, net.

Three-quarters of this work is on the apparatus for the production of light from electric current, and the final third relates to the utilization of light. The work is professedly the development of lecture notes for technical students, but the plan and scope of the notes seem different from those evident in the majority of courses.

The book opens with a compilation of data on the transmitting, reflecting and absorbing qualities of various surfaces. There is much about the general performances of various kinds of light sources. The data thus presented carry no evidence of the conditions of derivations and it is evidently the author's intention to give them as general indications only.

After this general matter the author takes up the principle of photometry and describes photometric-laboratory methods and apparatus.

The various types and shapes of incandescent lamps and their many kinds of filaments are described. Next the author passes to the older forms of arc lamps and follows with descriptions of the newer developments—the luminous arcs, vapor and rarified-gas lamps.

The section on the engineering of utilization begins with a discussion of the functions of shades, globes and reflectors. This is, in turn, followed by notes on the pre-calculation of illumination—largely in respect to problems in securing uniform illumination over more or less restricted areas.

The author has, throughout, brought together many of the latest developments in lighting. The book suffers from carelessness of statement on minor points, and the effect is increased by typographical errors and omissions.

It is to be regretted that the [illegible]or has not better utilized this opportunity [illegible]combine the results of latest development w[illegible]imple ideas of what leads to good illuminati[illegible]It is striking to note the omissions of a[illegible]iscussion of the very principles on which hyg[illegible]and artistic illumination depend. It would[illegible]m that the presentation of such general ide[illegible]uld be of greater benefit to young engineer[illegible]nd to students than giving them compar[illegible]y complicated methods of designing a [illegible]ly-uniform illumination or descriptions of [illegible]ratory apparatus not widely seen in com[illegible]practice. Advanced studies, like Steinmetz[illegible]olt-ampere equations of the electric arc, are [illegible]printed to the exclusion of a simple explanati[illegible]of the difference between direct and alter[illegible]ng-current arcs, and between carbon and othe[illegible]lectrodes.

It would have been possible to h[illegible]used such opportunities as touched upon for a greater service to engineering students witho[illegible]increasing the size of the volume. There are a few more places where condensation or elimination would have been permissible. What the volume covers is in convenient and accessible form so that the reader will be sorry the author stopped short of making it a great book.

STATICS BY ALGEBRAIC AND GRAPHIC METHODS.—Intended Primarily for Students of Engineering and Architecture. By Lewis Jerome Johnson, M. Am. Soc. C. E., Professor of Civil Engineering in Harvard University. Second edition, revised and enlarged. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¾ × 9¼ ins.; pp. 169; 13 plates and 70 text illustrations. $2; English price, 8s. 6d., net.

The second edition of Prof. L. J. Johnson's "Statics" improves on the first (reviewed in this Supplement for April 16, 1903, p. 48) by some added appendices, such as a new set of problems, a syllabus of the book, etc. The new matter will interest mainly the teacher. As a clear, accurate text-book for the study of elementary Statics the book is just as valuable as when first published.

HYDRAULIC TABLES.—The Elements of Gagings and the Friction of Water Flowing in Pipes, Aqueducts, Sewers, etc., as Determined by the Hazen and Williams Formula; and the Flow of Water over Sharp-Edged and Irregular Weirs, and the Quantity Discharged, as Determined by Bazin's Formula and Experimental Investigations upon Large Models. By Gardner S. Williams, M. Am. Soc. C. E., Professor of Civil, Hydraulic and Sanitary Engineering, University of Michigan, and Allen Hazen, M. Am. Soc. C. E. Second edition, revised and enlarged. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¾ × 9¼ ins.; pp. 104; text illustrations and one plate. $1.50; English price, 6s. 6d., net.

The first edition of this valuable set of tables was reviewed in our issue of Sept. 14, 1905, to which our readers are referred. In the present edition, according to the preface,

> the changes are confined to that part of the book devoted to the flow of water over weirs, where some new matter relating to submerged weirs is presented in the text, and where the table of discharge by Bazin's formula has been extended to cover variations of head by 0.01 ft. from zero to 6 ft., making in all a table of 30 pages instead of the two pages in the former edition. A table of discharge of high weirs, 10, 20 and 30 ft., under heads from 6 to 20 ft. has been added.

ATLAS OF CANADA.—Prepared under the direction of James White, F. R. G. S., Geographer. Department of the Interior, Canada, Hon. Frank Oliver, Minister. (Ottawa, Can.: Pub. Doc.) Cloth; 12½ × 18 ins.; pp. 21; 83 plates.

In the field of geographical publications it is generally admitted that the various governments of the world are serious rivals of the commercial publishing houses. The Canadian government has not belied the reputation in the atlas noted above. It consists of some eighty odd large plates, containing not only the usual geographical, geological and topographical maps, but also much other necessary but seldom published mapped data on telegraphs, telephones, limits of forest trees, isotherms, routes of explorers and population distribution. In addition to these maps there are the usual statistical charts on trade and commerce, population, agriculture, vital statistics, finance, currency and banking, fisheries, railways and education. Not only the material presented but the admirable arrangement and typographical work is a great credit to the Department and to Mr. James White, Geographer, under whose direction the book was prepared.

The Elementary Abstract Principles of Hydraulics and Their Application to Hydraulic Power Engineering.

Reviewed by F. C. FINKLE.*

HYDRAULIC ENGINEERING.—A Practical Treatise on the Principles of Water Pressure and Flow and Their Application to the Development of Water Power, Including the Calculation, Design and Construction of Water Wheels, Turbines, and Other Details of Hydraulic Power Plants. Part I.: Hydraulics. By Frederick S. Turneaure, Dean, College of Engineering, University of Wisconsin. Part II.: Water-Power Development. By Adolph Black, Adjunct Professor of Civil Engineering, Columbia University, New York. Chicago, Ill.: American School of Correspondence. Cloth; 6¼ × 9¾ ins.; pp. 267; plates and 200 text illustrations. $3.

This volume is a compilation of certain data relating to hydraulics and hydraulic power development. It consists both of matter quoted directly from other authors and magazines and of matter adapted from such authors and magazines, or from the trade publications of manufacturers. Due credit is given to these various sources of information for the material thus selected and assembled.

The name of the book is misleading, as it deals exclusively with the abstract principles of hydraulics and their application to hydraulic power engineering. "Hydraulic Engineering" is really a broad subject, covering hydraulics, hydraulic power, irrigation, public water supply, etc., while this work covers only the first two subjects.

As the treatment is strictly elementary and descriptive, rather than technically advanced and practical, the book is useful either to those beginning the study of these subjects, or to young engineers just entering upon their practice. No doubt this was the aim of the authors, as it is a production for the American School of Correspondence; and the fact is not stated as a criticism of the book, or its authors.

Part I. is devoted to abstract hydraulics. It does not pretend to cover all, or even a majority, of the principles of hydrostatics and hydrodynamics, but presents such rules and formulas as are necessary to solve the simplest and most commonplace problems only. More than this, however, cannot be expected from a treatment of the subject covering only 55 pages, as it would require at least five times as much space to make a complete presentation of abstract hydraulic science. The arrangement of this part is excellent, and it is also to be highly commended for the clear and condensed text. The figures used to illustrate the text are selected with good judgment and are so drawn as to make the important points clear to the mind.

The only article in Part I. open to much criticism is No. 28, on "Formulas for Friction Loss in Pipes." It is safe to say that hydraulicians have long since learned that the Chezy formula, with a constant coefficient for each class of pipe, is only a rough way for arriving at approximate results. Without going much into a subject so well understood among engineers as this one, it is still well to remark that an exponential formula for the flow of water in pipes gives the most accurate results for such cases. It is therefore to be regretted that a book intended to start students and beginners in the right direction should not have adopted the most scientific and advanced formula.

Part II. is given up to that branch of hydraulic engineering having to do with the development of power from falling water. The treatment of the subject is such that there is little to criticise and much to commend. This is especially true in regard to the analysis of hydraulic turbines. It begins with the very rudiments of the science and carries one up to the actual point where the theory of hydraulic motors ends and their design, construction and installation begins. The ground between these limits is well covered and the text and formulas are sufficiently full and clear to make the student's conception of the science complete.

Occasionally matter relating to the more advanced and practical side of the subject is injected. This, however, is apparently done for the purpose of making the student realize that there is a practical application of the various theories, since it is not so complete as to assist a designing and constructing engineer in his work.

That portion of the book which includes Articles 183 to 188, possesses less value than any other. This should either have been written as a theoretical discussion of the subjects covered, or it should have been carried much further than it was. At present it is too descriptive for a scientific treatise on the design of head-gates, penstocks and hydraulic conduits in general, while at the same time the descriptive matter is either too general or confined to unnecessary details.

As illustrating matter of too general a character is that on pages 182 and 186, relating to wooden and reinforced concrete penstocks, wherein no principles are stated on which calculations can be based to determine their applicability to various conditions. Neither are the rules governing their design made so clear that a student or beginner can tell how to begin and complete the design of either.

As a sample of special detail not necessary in most cases is the recommendation, on pages 181 and 182, that buried steel plate penstocks should be kept for a year in an open trench on wooden blocks before the trench is backfilled, and a drainage ditch be constructed below the pipe and filled with pebbles and broken stone. While such precautions may be necessary in some cases, where the ground is treacherous and saturated with water, these are the exceptions and not the rule.

The reviewer cannot approve of all that is said in Article 188, and the illustrations are almost wholly inapplicable to the subject. In water-power work a distinct type has been developed for feeder conduits, or gravity conduits, as they are often called. The illustrations from Figs. 143 to 156, inclusive, are of irrigation conduits, with three exceptions: Fig. 153 being of a type of power flume which has proved very unreliable; Fig. 154 being a power flume, which had to be discarded and replaced by a tunnel in five years after its construction; and Fig. 155 being a cheap and flimsy "V" flume for floating lumber. Irrigation conduits are not suitable for use in connection with power plants. The interruption of an irrigation channel by washouts or slides occurring in storms is of slight consequence, as the water is not needed until repairs can be made. But for a power plant the water must be continuous at all times. Hence this class of service is very exacting and demands a type of construction capable of withstanding the most severe onslaught from the elements.

The matter appearing in the back of the book is very valuable to a student, as it furnishes concrete examples, showing how what precedes it may be applied in actual practice. The plants selected for description are some of those most widely known and represent many different types of construction. Improvement in two directions might have been made: (1) by including one or more of the most recent and highly improved power plants among these older ones; and (2) by differentiating those described as to their durability and efficiency, as shown by experience since their construction.

Articles 238 to 248, relating to load factors, power costs, power charges, etc., are a valuable addition to this book. While the reviewer agrees in the main with what is there said, there are two things, wherein the discussion is more or less incomplete and capable of improvement. After all, the real test of whether a water power can be made a commercially profitable development or not depends on what its output in kilowatt-hours can be delivered in the market for as compared to power from a steam plant to serve the same market. Hence in reporting on a water-power development it does not matter so much what may be its installation cost per kilowatt of rated capacity, but what its kilowatt hours will cost delivered to the consumer. In making such a comparison, there must be considered the fixed charges, depreciation, maintenance, cost of operation and load factor of the proposed water power and its possible competitor in the form of a steam plant. The result reduced to cost per kilowatt-hour for both will show the advantage of either.

In regard to charging rates to consumers, it seems to the reviewer that a more equitable and simpler method than those discussed is to charge the consumer a "readiness to serve" rate per kilowatt on his installed capacity, with an additional amount per kilowat-hour for what he consumes. If the "readiness to serve" charge is rightly made it will cover fixed charges and depreciation to the power company on its plant capacity reserved for the consumer, while the kilowatt-hour rate can be made to cover other matters relating to the actual delivery of the power and the power company's profit. Such an arrangement protects the consumer equally well, as the improvement of his load factor lessens the cost per kilowatt hour of the power he receives.

In conclusion, it may be said that this book is of value chiefly to students who are beginners in the study of this branch of hydraulic engineering. It also possesses a considerable value to young engineers practicing in the same line, who have not worked long enough to be familiar with elementary principles and some of the examples illustrating them. To such it is a valuable book of reference if used with a proper amount of caution.

To illustrate this admonition attention may be called to the fact that the vortex baffle plate shown in Fig. 56, page 74, does not in practice accomplish what is claimed for it, as its use in Mill Creek No. 3 plant near Redlands, Cal., demonstrated a tendency to throw the water vertically into the air, and this trouble was only partially overcome by heavily covering the tail race. It may also be noted that the design and arrangement of water motors for the Snoqualmie Falls plant, as described in Article 212, page 237, resulted in very poor efficiency, probably not over 60% in the water wheels themselves. Other similar differentiations might be made, but space forbids doing so.

In the foregoing review everything in the book has been discussed alike, regardless of whether it is original matter or copied from and credited to other authors.

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COURS DE PONTS METALLIQUES.—Professé a l'Ecole Nationale des Ponts et Chausées. By Jean Résal, Inspecteur Général des Ponts et Chausées. (Part of "Encyclopédie des Travaux Publics," Begun by M. C. Lechalas.) Vol. I. Paris, France: Ch. Béranger. Paper; 6½ × 10 ins.; pp. 663; 373 illustrations in the text. 20 francs; American price, $6.

The present work on metal bridges is part of an encyclopedia and follows in that series a book on "Resistance of Materials" which treats of the methods, both analytic and graphic, used in the calculation of all metal structures, particularly bridges. In the later book, the author assumes a knowledge of the general methods, but takes up the more simple theories and the practical side of metal bridge design, fabrication and construction. The work is extremely long and bulky, so much so that it will have small value to the American engineer. It is, however, an exhaustive treatise, which should have a large field in its own country and among those who are studying the large problems of bridge design.

ON THE AMELIORATION OF RIVERS WITH UNSTABLE BEDS BY THE SYSTEM AUDOUIN.—Translated from the French at the Engineer School, 1908. No. 34, Occasional Papers, Engineer School, U. S. A. Washington Barracks, D. C.: The Engineer School. Paper; 6 × 9 ins.; pp. 40; folding and other plates, and text illustrations.

The contents of this pamphlet are better explained by the sub-title, which reads as follows:

"On the Amelioration of Rivers with Scourable Bottoms and Especially of the Loire: Extract from Nouvelles Annales de la Construction, April, 1904. Followed by a Project for a Trial of the Oblique Dams with Suspended Movable Vanes (System Audouin). By M. Chemin, Ingenieur en chef des Ponts et Chaussées en retraite, Formerly Professor at National School of the Ponts et Chaussées."

The system which is described comprises a wing dam, with vanes or shutters moving up and down in a vertical plane, which is thrown out from the convex point of a compound curve in a river, so as to clear out the sand bar which is liable to form at this point.

A Satisfactory Text-Book on Steam Boilers.

Reviewed by CARL C. THOMAS.*

STEAM-BOILERS.—By Cecil H. Peabody, Professor of Naval Architecture and Marine Engineering, and Edward F. Miller, Professor of Steam Engineering, Massachusetts Institute of Technology. Second edition, revised and enlarged. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¾ × 9¼ ins.; pp. 434; 5 plates and 176 text illustrations. $4; English price, 17s., net.

There are not many books which are well adapted to the use of college students as texts on the subject of Steam Boilers. This book is preeminently suited to that purpose, and in its revised form it contains a satisfactory amount of material, well selected, for use by students and others wishing to obtain a knowledge of the principles underlying steam boiler design and operation. It is well understood that nothing but actual engineering experience in design and operation can make a competent engineer, but that a certain part of the mental equipment required can be obtained by the careful study of well-written books dealing with fundamental principles. The text-book should afford discussions of such fundamentals, and may properly illustrate them by showing how they have been applied in practice. All this is supplied in the book by Professors Peabody and Miller, and a considerable portion of the book deals with processes used in building boilers, and with considerations bearing upon the selection of accessories, settings, stokers, and other features of a boiler plant.

A fault, however, shared by many books on technical subjects, is found in parts of this book, in that specific directions and statements are set forth as of general application, which in reality apply only in special cases. There are comparatively few such statements in the present book, and these would not mislead any but inexperienced engineers. The tensile strength of cast iron in its various forms is not at the present time limited to between 12,000 and 20,000 lbs. per sq. in., as stated on page 191. A better statement would place it at from 18,000 to 25,000 lbs. The writers qualify the first statement by saying that special care and skill result in the attainment of tensile strength in cast iron made from special stock, and called gun iron, of 30,000 lbs. per sq. in. This figure might be raised considerably and would more nearly represent present practice if the figure given were 36,000 lbs. Again, the strength of triple-riveted boiler-shell joints, like that shown on page 214, is not necessarily represented by an efficiency of between 85 and 90%. In frequent cases, where such joints are designed with reference to steam-tightness as well as to economy in manufacture, the least efficiency may not exceed 80% and is sometimes considerably lower than that. This criticism applies particularly in cases where the shell plating is thicker than that used in the example worked out in the book; as, for example, in large cylindrical internally fired boilers.

In these and a few other places the book might be criticized as being written from an academic standpoint, but, at the same time, a book for use by teachers in technical schools is usually better suited to its purpose if written by a capable teacher than if written by a practicing engineer. Professors Peabody and Miller are eminent teachers; their book is carefully written, and the few points open to criticism do not affect the value of the book to any serious extent. The only other book covering essentially the same ground and adapted for use as a text is H. de B. Parsons' "Steam Boilers," also an excellent book for the use of college students or for reference by the engineer.

The arrangement of Peabody and Miller's "Steam Boilers" will commend itself especially to teachers. Chapter I. deals with some of the leading types of boilers and contains a few well-chosen illustrations. Chapter II., dealing with superheaters, is one of the additions to the second edition of the book. It gives a brief treatment of this important subject, and might have been extended somewhat to good advantage. There is, however, a large amount of information available in recently written technical papers dealing with the use of superheaters. References to such papers would be welcome additions to this chapter. Chapter III., on fuels and combustion, outlines the theory of the subject and gives numerical examples of methods of calculation. This is followed by a chapter on corrosion and incrustation, showing the effects produced by chemical action in boilers and outlining methods used for preventing deterioration.

Chapter V. deals with boiler settings, furnaces and chimneys, while Chapter VI. discusses methods of estimating boiler horsepower. The remainder of the book deals in detail with the structure and strength of boilers, describes boiler accessories, shop practice relating to boiler construction, and the testing of boilers. Chapter XII. deals with the design of stationary boilers, particularly of the horizontal return-tubular type. The example worked out is representative, and will be of use to those giving instruction in this subject, as well as to engineering students in general. An appendix gives various tables of particulars relating to special types of boilers and their settings, data regarding fuel economizers, and other tables applying in a general way to the subject of steam boilers. Five folding plates in the back of the book give detailed drawings of certain types of fire tube boilers and of the design of a brick smokestack. These designs have evidently been taken from practice and are useful as illustrations of the subject matter of the book. The subject of steam piping, expansion joints, etc., has received additional consideration in this edition.

The subject of steam boilers is one which can hardly be treated fully in one volume, and it is interesting to classify some of the books which have been written on various phases of the subject. They may be arranged somewhat as follows:

(1) Compendiums of general and specific information pertaining to boilers. Examples: Boilers, their construction and strength, by Thomas W. Traill, R. N.; A Treatise on Steam Boilers, by Wilson and Flather; Steam Boilers, Their History and Development, by H. H. P. Powles; Steam Boilers, W. H. H. Shock; Useful Things to Know About Steam Boilers, G. B. N. Tower, Supervising Inspector, American Steam Boiler Insurance Co.; A Manual of Steam Boilers, R. H. Thurston; Steam Boilers, W. M. Barr.

(2) Books pertaining to efficiency tests and experiments bearing on boiler performance, F. J. Rowan, The Practical Physics of the Modern Steam Boilers; Bryan Donkin, The Heat Efficiency of Steam Boilers.

(3) Treatises on special classifications of boilers. Examples: Bertin and Robertson, Marine Boilers; C. E. Stromeyer, Marine Boiler Management and Construction; Dr. G. Bauer, Marine Engines and Boilers; Leslie Robertson, Water Tube Boilers.

(4) Treatises on theory of heat with special reference to steam generation. Example: Practical Treatise on Heat, by Thomas Box.

(5) Text-books aiming to state general principles of design and construction, and to give examples of their application. Examples: H. de B. Parsons, Steam Boilers; Peabody and Miller, Steam Boilers.

The last-mentioned book, by Professors Peabody and Miller, which has been noticed at length above, is one of the standard text-books in use in the leading technical institutions of this country, and it is certain to continue to occupy a high place among the many books that have been written on steam boilers.

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VALVE SETTING.—Simple Methods of Setting the Plain Slide Valve, Meyer Cut-Off, Corliss and Poppet Types. Compiled and written by Hubert E. Collins. New York and London: Hill Publishing Co. Cloth; 6 × 9½ ins.; pp. 200; 200 illustrations in the text. $2.

The main part of this book consists of detailed directions for setting the valves of steam engines, including piston valves, the riding cut-off, gridiron, Corliss, Porter-Allen, Wright and Fitchburg types. In the latter part of a chapter on air compressors, directions are given for setting the valves of compressors and blowing engines. These directions are supplemented with adequate illustrations of the valves and valve gears, and are, as a whole, sufficiently explicit and clear. The compiler gives his assurance that they have in each case been referred to the engine builder for approval. This portion of the book occupies about three-fourths of the total number of pages. About this nucleus of good mat[illegible] have unhappily been clustered a few stray c[illegible]pters which would be less regrettable were th[illegible] not marred by a widespread dubiety in the le[illegible]ring of the figures. This defect is particularl[illegible] annoying in the chapter on the Zeuner valve di[illegible]am and in the first part of the chapter on air [illegible]mpressors. It is hard, also, to understand just w[illegible] a chapter on the D slide valve, in which the [illegible]euner diagram is used with the evident assu[illegible]ption that the reader is already familiar with i[illegible]hould precede a chapter explaining the diagr[illegible]. It may be well to note at this point that [illegible]tailed instructions for setting the plain D sli[illegible] valve are not given. It may possibly be with[illegible]e idea of offsetting this deficiency that there [illegible] tucked in near the back of the book an article [illegible] the cross exhaust for duplex pumps, which [illegible]ears also in "Pumps," by the same compiler, [illegible]viewed in our issue of Dec. 17, 1908.

Apart from these supplementary ch[illegible]pters, the valve setting instructions themselves [illegible]re a valuable addition to this class of literat[illegible]re in that they collect in one book information otherwise obtainable only from a number of widely scattered sources. It is possible, too, that the undesirable portions noted above may do no harm—although, for example, the misprinting of the exponent, 1.41, as a coefficient or multiplier throughout the equations for adiabatic expansion in the chapter on compressors, might tend to confuse someone not fairly familiar with thermodynamics.

ASPHALTS.—Their Sources and Utilizations. Asphalt for Dustless Roads; Recent Improvements in Asphalt Industries; Together with Addenda Treating on General Waterproof Construction. By T. Hugh Boorman, Civic Engineer and Asphalt Expert. New York: William T. Comstock. Cloth; 6½ × 10 ins.; pp. 168; plates and text illustrations. $3.

The preface states, among other things, that this book was suggested by a series of articles that appeared some time since in "Architects' and Builders' Magazine." Since the numbers containing these articles ran out of print, there has been a continuous call for them, and the request was made that they be issued in book form. . . . . .

I have endeavored, without fear or favor, to give credit to all producers of asphalt in every country and clime and to give to all their due. . . . . .

This book is the result of 36 years of active life among asphalt mine owners, refiners, importers, exporters, manufacturers and contractors, and, as will be seen, has taken me to many countries, in all of which I have endeavored to glean information from all interested, from presidents of corporations to the humblest stirrer of an asphalt kettle.

As might be expected from a book having such an origin, the volume consists chiefly of quotations from various papers and reports. It is useful in bringing together in one place a considerable amount of information on many phases of asphalt and its uses, which was previously widely scattered. The author does not appear to have given the reader very much of the benefit of his "36 years of active life" among asphalt men, in so far as criticism of the opinions of others or expression of his own opinions is concerned. The illustrations are all half-tones, and many of them have no particular relation to the subject, further than that they show buildings in some portion of which asphalt was used. Most of the half-tones, however, are excellent examples of this type of engraving and add to the popular interest of the book.

THE WATER POWERS OF WISCONSIN.—By Leonard S. Smith; Engineer, Wisconsin Geological and Natural History Survey. Pub. Doc.: Madison, Wis. Cloth; 7 × 9¾ ins.; pp. 354; illustrated.

The preface states that few other States are so favorably situated in regard to water-power as is Wisconsin.

While single developments of from 10,000 to 30,000 HP. are not wanting, it is their general distribution over nearly the entire state, rather than the neat size of a few plants, that is most characteristic of Wisconsin water powers. The total water power in the state at present developed, approximately 130,000 HP., is only a small proportion of the total power awaiting development.

In order to secure greater publicity, the State Legislature of 1905 appropriated $2,500 for making surveys of the water-powers and for preparing a report on the results. The present report (which is classed as Bulletin XX. of the Wisconsin Geological and Natural History Survey) is stated to be a first step in furnishing the information needed by the public. It includes also the run-off records of the U. S. Geological Survey in

Wisconsin from 1902 to the end of 1907. After a review of the physical geography of the State, the individual description of various river systems is taken. This includes their topographic and hydraulic features, and the various water-power development plants. This part of the book covers nearly 300 pages. In addition, about 17 pages are devoted to a tabulated chronological list of the grants of dam charters or privileges by the legislature of Wisconsin from 1838 to 1907. The book is illustrated by numerous maps and diagrams, and by half-tone engravings of views of the rivers, dams and development works.

Metallurgical Experiments.

Reviewed by W. Campbell.*

LABORATORY EXPERIMENTS IN METALLURGY.—By Albert Sauveur, Professor of Metallurgy and Metallography in Harvard University, and H. M. Boylston, Instructor in Mining and Metallurgy in Harvard University. Cambridge, Mass.: The Authors. Cloth; 7¾ x 10¼ ins.; pp. 73; 17 text illustrations and 10 tables. $1.25.

This book consists of short notes written primarily for the use of students at Harvard University, who take the courses in General Metallurgy and in the Metallurgy of Iron and Steel.

The book is divided into two parts. The first contains 13 experiments in general metallurgy: coking and proximate analysis of coal; calorimetry—the Parr calorimeter; pyrometry—the Siemens water pyrometer, the Mesuré and Nouel optical pyrometer, the Le Chatelier thermo-electric pyrometer; the melting points of tin, lead and zinc; reduction of copper oxide by carbon; reduction of lead oxide by carbon; reduction of iron oxide by metallic aluminium—the thermit reaction; reduction of copper oxide by copper sulphide; reduction of lead oxide by lead sulphide.

Part Two consists of 13 experiments in iron and steel as follows: influence of carbon upon the tenacity, elasticity and ductility of iron; the influence of nickel on the tenacity, elasticity and ductility of iron; the thermal critical points of steel; the changes in magnetic properties occurring at the thermal critical points; relation between the critical points and the hardening power of steel; the brittleness produced by hardening; the hardness produced in high carbon steel by sudden cooling (quenching) from a high temperature; influence of hardening upon the ductility, elasticity and transverse strength of steel; influence of carbon upon (1) the hardness, (2) the hardening power of steel; influence of the nature of the quenching bath upon the hardening of steel; tempering of hardened steel; influence of certain heat treatments upon the physical properties of steel; effect of annealing on the properties of cold worked steel; effect of heat upon the grain of steel.

There are several tables in the text, such as typical analyses of various fuels; corrections for decrease in weight of iron and copper cylinders of the Siemens water pyrometer; temperatures, tables for use with the Mesuré and Nouel; melting points of metals; thermochemical data, etc. After each experiment is attached the laboratory report to be filled by the student.

In Part One the choice of experiments has been well made. Experiment 5 might have been increased by the addition of the melting and freezing point of copper and an explanation of the method of calibrating the Le Chatelier pyrometer. As the Wanner and Féry pyrometers have found much favor in the works, it is to be hoped that they may be added in a subsequent edition.

In regard to the second part of the book 9 of the 13 experiments require the use of a testing machine, and this does not as a rule form part of the equipment of a metallurgical laboratory. However, metallurgical students generally have access to such a machine in the engineering departments. The experiments chosen serve to emphasize the influence of carbon in the physical properties and the relation of the critical points to the hardening power of steel.

The book as a whole is to be commended for its simplicity and clearness. A few experiments have been chosen to demonstrate to the student the fundamental principles involved, and these experiments have evidently been written up from notes of actually performed work. In the second place they call for thought on the part of the student, rather than the mere performance.

In the teaching of metallurgical laboratory work, the personal leanings of the instructor are a great factor in the choice of what is taught. In this book, the work is so broadly laid out that it will serve as a basis for courses of widely different aspect. For example, though only three metals are given under the section on the Le Chatelier pyrometer, other metals such as antimony, aluminium, copper or various alloys may be used. This is specially true of Part Two where the work can be very easily expanded by using other material and by the addition of metallographic examination of the specimens used, contrasting structure with treatment, composition and physical properties.

The authors are to be congratulated on turning out a book for which there is a growing demand.

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A Revision of Schuyler's Reservoirs.

RESERVOIRS FOR IRRIGATION, WATER-POWER AND DOMESTIC WATER-SUPPLY.—With an Account of Various Types of Dams and the Methods, Plans and Cost of Their Construction. By James Dix Schuyler, M. Am. Soc. C. E., M. Inst. C. E., etc. Second edition, revised and enlarged. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 6½ x 10¼ ins.; pp. 573; 381 illustrations, mostly in the text, and 6 folding plates. $6.

The revision and enlargement of this book has added materially to its size and value. The author states that the present edition includes 234 new illustrations. Many of these are photographs, "some of which have been taken by the author's pocket camera—an inseparable companion." About 60% of all the illustrations are said to be new, and as much or more of the reading matter either new or rewritten.

In review of the first edition of this book, which was published in our issue of June 13, 1901, we said:

> Aside from brief statements of the principles involved in the design and construction of each type of dams, and criticisms of the various structures reviewed, the book, in the words of Mr. Schuyler,
>
> is chiefly a straightforward description of those works with which the author has become familiar, either as consulting engineer, or as designer and constructor, or merely as an interested observer of the work of other engineers.
>
> When well presented, as this one is, books of the kind described often form the most useful sort of technical literature.

The book should still be judged chiefly as a collection of descriptions of the large and otherwise important dams of the world. As such it is of the highest value.

One of the new and unique features of the present edition is the comparative sections of masonry and earth dams which the author has assembled on plates, all sections being drawn to the same scale. There are three of these sheets for masonry dams. One sheet shows cross-sections of 9 dams in Spain and 22 in France; another shows 35 sections of dams in other foreign countries; the third of these plates shows sections of 29 American dams. Of earth dams 15 are shown, on three plates. Three of these structures are in California, and the others are located in Great Britain, Ireland, India and France. Sections of many of these earth dams are also given in Wegmann's "The Design and Construction of Dams," but in that work each is exhibited on separate sheets.

Besides the plates just mentioned, the appendix contains a valuable table showing the acre-foot cost of 75 reservoirs, of which 45 are in the United States and 30 in foreign countries. The character of each dam is stated, the capacity of the reservoir in acre-feet, the total cost and the cost per acre-foot. For users of the book other than those interested solely in irrigation, time would have been saved had the author based his capacity and unit costs on millions of gallons of capacity, and if he could also have given it in cubic feet the convenience of the table would have been still further increased. These suggestions seem pertinent in view of the title of the book—"Reservoirs for Irrigation, Water-Power and Domestic Water-Supply." As a matter of fact, it seems likely that the users of this book, if divided into classes, would fall in reverse order. Irrigation engineers, only, are in the habit of considering water in acre-foot units.

The foregoing quotation of the title of the book also suggests that the leading word would have been far more descriptive of the contents of the volume had it been "Dams" instead of "Reservoirs." The origin of the work, however, may account for the fact that reservoirs are given first place. As some of our readers know, the first edition of the book was an enlargement of a paper prepared by the author a dozen years ago, to form one of the Water-Supply and Irrigation Papers issued by the U. S. Geological Survey.

Other minor criticisms of the book might be made, such as some relating to matters of arrangement, particularly the placing of statements of principles governing the design or construction of the different types of dams sometimes in one part and sometimes in another part of the chapter devoted to each type. But no one really ought to find much fault with a book which contains such a vast amount of useful information as does this one, particularly when the information as a whole is in accordance with the plan of the author, is quite convenient for reference purposes, and much of it is nowhere else accessible. The wonder is that so busy a man as Mr. Schuyler should have found time to collect and put into so good shape for publication such a large amount of valuable material.

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OSKAR NAGEL, Ph. D.

P. O. Box 385 NEW YORK

Ocean Transportation.

THE OCEAN CARRIER.—A History and Analysis of the Service and a Discussion of the Rates of Ocean Transportation. By J. Russell Smith, Ph. D., Assistant Professor of Industry in the Wharton School of Finance and Commerce, University of Pennsylvania, Author of "The Organization of Ocean Commerce," etc. New York and London: G. P. Putnam's Sons and Railroad Age Gazette. Cloth; 5 x 7¾ ins.; pp. 344; 38 plates. $1.50.

We cannot too highly commend this book. The subject of shipping is one that appeals to popular interest; but it is one on which at least 99% of educated Americans are densely ignorant. The generation that lived in the days before the Civil War, when American ships sailed on every sea, knew perfectly the conditions of the sea trade of that day; but the sea trade of the present differs as greatly from the conditions then prevailing as those conditions differed from conditions in the days of Columbus and Drake.

A vast deal has been written concerning the disappearance of the American flag from the high seas, concerning the decline of such once famous seaports as Salem and New Bedford, concerning the fact that American goods shipped to South America are sent by way of Europe instead of direct, concerning the profits of the shipping business. And much the largest part of all that appears on these and kindred subjects, in the newspapers, in popular magazines, and particularly in the addresses of public men, is either the result of dense ignorance or is based on that partial knowledge which is proverbially dangerous.

We wish this book might be read by every American business man and professional man, and particularly by every man in public life. The business of sea transport affects every individual in the land. The rates and facilities for sea traffic are closely related to the cost of

the necessaries of life and the earnings and profits of ten thousand industries. Prof. Smith's book gives the facts regarding this great industry in complete form and with a broad grasp of essentials and a clear understanding of the economic factors in the industry that commands admiration.

Withal the book is written in most entertaining style. It is as fascinating as a novel. Much more interesting in fact than nine-tenths of the productions of current fiction writers. Its treatment of the subject is popular rather than technical and the book is all the more valuable for it. One or more copies ought to be placed in the library of every engineering school and its reading might well be required in the course.

The student will gain from it some history and economics that he will obtain from no other source, in addition to accurate knowledge concerning a world industry that may at some future day be of great value to him.

The Power Gas Producer.

Reviewed by ALFRED E. FORSTALL.*

MODERN POWER GAS PRODUCER.—Practice and Applications. A Practical Treatise Dealing with the Gasification of Various Classes of Fuels by the Pressure and Suction Systems of Producer. By Horace Allen, Author of "Gas and Oil Engines," etc. New York: D. Van Nostrand Co. Cloth; 5 x 7½ ins.; pp. 326; 136 illustrations in the text. $2.50, net.

Although nowhere so stated, directly, it appears from a reference in the preface that this book is a reprint of a series of articles which originally appeared in "The Practical Engineer," with the addition of an appendix dealing with several forms of producers developed since the articles were written. Periodical literature may be judged leniently, but there is no object in publishing in book form matter on a subject that has been treated in so many books in recent years as has that of producer gas and gas producers, unless the book so produced differs from its predecessors either in treating the subject from an entirely original point of view or in containing new matter which brings the knowledge of the art down to date. In neither way does the book under review justify its existence.

About half of it is devoted to descriptions of gas producers, both pressure and suction, made by different manufacturers, and the impression given by this portion is that it is composed of extracts from catalogs or descriptive circulars issued by these various manufacturers. A collection of descriptions of this character has value in enabling a person fairly well versed in the art to compare different types of apparatus and study the different solutions of the problems involved in the design of gas producers. The catalogs and circulars themselves can be easily obtained, however, and descriptions of, with one or two exceptions, European types of apparatus, without any comment as to what is good and what is bad in their design, are not of much service to the American student of producer gas practice.

The use of this matter is responsible for conflicting statements confusing to a person seeking information. Take for instance the subject of the relative advantages of the rival methods of obtaining from bituminous coal, gas free from tarry matter. One of these methods is to pass the volatile products, driven off from such coal, through a layer of incandescent fuel for the purpose of decomposing the hydrocarbon vapors in these products, and the other is the removal of the tar mechanically after the gas has left the producer and has been cooled. One who was in doubt as to which of these methods was the better would not have his doubts removed by reading on page 59 that since the first method was only partially successful and complicated the apparatus it was better to employ the second, and on page 139 that the first method being the best should be employed to prevent condensible vapors from being mingled with the gas, especially since these contradictory statements are made with reference to two types of apparatus made by one and the same firm.

The other half of the book deals briefly with natural gas in England and the application of producer gas to the propulsion of boats, and at slightly more length with various chemical and physical properties of gases, including specific heat, calculation of the volume of gas produced from a given weight of fuel of known composition, calorific value, flame temperatures and explosive pressures and gas analysis and calorimetry. The final chapter gives information in regard to the English patents, granted during 1906 and 1907, which bear upon the subject of producer gas.

In the chapter on specific heat a table is given which shows that the specific heats of gases are greater at high than they are at low temperatures, but later on specific heats at ordinary temperatures are employed in the calculation of flame temperatures and nothing is said as to the error which this introduces into the calculation.

All through the book are found examples of carelessness in expression, such as calling the initial temperature the "absolute initial temperature" and thus confusing it with the absolute temperatures that are being used in the same paragraph.

Taken as a whole, the book is written in a rather slipshod manner, which might have been excusable in the original articles, but should have been corrected when they were published in book form. If there were no other books on the subject this one would have value, but it is not equal to several of its predecessors.

*Consulting Engineer, 58 William St., New York City.

Five Recent German Books.

DIE AUSNUTZUNG DER WASSERKRAEFTE.—Technische und Wirtschaftliche Grundlagen. Neuere Bestrebungen der Kulturländer. By E. Mattern, Regierungsbaumeister, Kgl. Wasserbauinspektor. Second edition, greatly enlarged. Leipzig, Germany: Wilhelm Engelmann. Paper, 6½ x 9½ ins.; pp. 652; 256 illustrations in the text.

LEHRBUCH DES HOCHBAUES.—Edited by Karl Esselborn. Vol. II.: Gebäudelehre, Bauformenlehre, die Entwickelung des Deutschen Wohnhauses, das Fachwerks- und Steinhaus, Ländliche und Kleinstädtische Baukunst, Veranschlagen, Bauführung. By Josef Durm, Karl Esselborn, Bernhard Kossmann, Emil Beutinger, Karl Stief, Heinrich Stumpf, Georg Rüth, Reinhard Weder. Leipzig, Germany: Wilhelm Engelmann. Paper; 7½ x 11 ins.; pp. 429; numerous illustrations in the text. 15 marks; American price, $6.

DER WASSERBAU.—Für Studierende und Praktiker. By M. Strukel, Professor at the Finland Technical College in Helsingfors. Part II.: Water-Supply, Sewerage, Drainage, Irrigation, and Canals for Navigation. Second edition, revised and enlarged. Leipzig, Germany: A. Twietmeyer. Paper; 7½ x 10½ ins.; pp. 239; 23 plates and 29 illustrations in the text. 16 reichsmarks.

DIE RATIONELLE AUSWERTUNG DER KOHLEN ALS GRUNDLAGE FUER DIE ENTWICKLUNG DER NATIONALEN INDUSTRIE.—Mit Besonderer Berücksichtigung der Verhältnisse in den Vereinigten Staaten von Nordamerika, England und Deutschland. By Franz Erich Junge. Berlin, Germany: Julius Springer. Paper; 6½ x 9½ ins.; pp. 91; ten illustrations in the text. 3 marks; American price, $1.20.

ZUSAMMENGESETZTE FESTIGKEITSLEHRE NEBST AUFGABEN AUS DEM GEBIETE DES MASCHINENBAUES UND DER BAUKONSTRUKTION.—Ein Lehrbuch für Maschinenbauschulen und Andere Technische Lehranstalten sowie zum Selbstunterricht und für die Praxis. By Ernst Wehnert, Instructor in the Municipal Trade and Mechanical School at Leipzig. Berlin, Germany: Julius Springer. Cloth; 6 x 9 ins.; pp. 224; 142 illustrations in the text. 7 marks; American price, $2.80.

Mattern's "Water-Power Development," reviewed in these columns Nov. 15, 1906, now appears in second edition, but meanwhile it has more than doubled in size. The general plan is the same: discussion of all those aspects of water-power development which concern the project as a whole; mainly commercial matters, such as cost and earning power, but necessarily embracing many technical questions. Roughly, half the book deals with engineering details, treating them sketchily, however, and not in the manner of a technical treatise; this, of course, is all that the purpose of the book demands. The other half is occupied by various matters on cost of works, selling price of electric power, relation of operating schedule to variations of water flow, etc., and with a review of recent hydro-electric work in the several civilized countries, statistical matter, legislation, etc.

Students of building in the architectural sense will find interesting illustrations and an intelligent text in the second volume of "Lehrbuch des Hochbaues." It contains condensed historical chapters on house-building, interiors, public buildings and churches, a chapter on styles and three chapters on German dwelling houses and other buildings. Estimating and specifying also have a chapter each. Speaking generally, the book contains nothing whatever to interest the engineer as such.

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A descriptive synoptic review of water-supply and water purification, sewerage and sewage disposal, drainage, irrigation works and navigation canals is found in Strukel's "Wasserbau," Part II. It is a modernized re-edition of an earlier work, and follows by three years the second edition of Part I., reviewed Feb. 16, 1905, p. 182. The principal part of the text is a series of short descriptive paragraphs explaining the illustrative drawings, the latter being grouped on 23 two-page plates at the back of the book. The work is too condensed to be of much service to the practicing engineer, but can be useful as a text-book in connection with fuller development of the subject by lectures.

A study in economics appears under the German equivalent of Rational Utilization of Coal. Its character and scope may be indicated by two of the author's conclusions: first, that it is wrong and wasteful to consume by direct combustion coals which might yield by-products in appreciable quantity, i. e., bituminous coals; second, that the exploitation of the coal resources should be under national control, to ensure maximum efficiency of utilization.

Mr. E. Wehnert dignifies the subject of Combined Stresses with a separate volume, though not a very bulky one. But his book is not a treatise; it may fairly be called an elementary text-book, as it employs the "common theory" instead of the abstruse theory of elasticity. Also, the mathematical work—and the entire volume is wholly mathematical—is held down to simple algebraic processes for wider availability. In order to accomplish the latter, of course, it is necessary to give deflection of formulas without proof. Some other integrations are reduced to algebraic form by expressing them as infinite series. The arrangement and method of the book are praiseworthy. We believe, however, that the subject is so intimately a part of the general subject of stresses, i. e., Mechanics of Materials, as to leave no place in school instruction for its segregation in a separate book. On the other hand, a comprehensive treatise, making due reference to results of experiment, should prove a worthy addition to engineering literature.

HIGH STEAM-PRESSURES IN LOCOMOTIVE SERVICE.—(A Review of a Report to the Carnegie Institution of Washington.) By W. F. M. Goss. Bulletin No. 26, University of Illinois Engineering Experiment Station. Urbana, Ill.: The University. Paper; 6 x 9 ins.; pp. 45; 21 illustrations in the text.

The conclusions of this report, and a discussion thereon, were given in Engineering News of Nov. 22, 1906, and Jan. 10, 1907, respectively.

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A Railway Employee on Railway Accidents and Management.

CONFESSIONS OF A RAILROAD SIGNALMAN.—By J. O. Fagan. Boston and New York: Houghton Mifflin Co. 1909. 4¾ × 7½ ins.; pp. 181; eight plates. $1.

As long ago as 1880 an authority on railway statistics said that "the chances of accident in railroad traveling are so small that they are not materially increased by any amount of traveling which can be accomplished within the limits of a human life." Doubtless this still holds true, though the percentage of accidents is increasing faster than the travel. From 1896 to 1906 the passenger mileage on the railways of the United States increased 100% and the numbers of persons injured in accidents 167%. And in this very increase in totals the horror of the individual accident overshadows the small chance of the occurrence of that accident.

The public has come to believe in the ability and honesty of intention of the railroad man. Whenever there has occurred an accident in a combination of man and mechanism it has become the habit to ascribe it to the failure of the mechanism, or if plainly there was human error the accident generally was charitably called unpreventable. This tendency has naturally been fostered by the men who manage and who are employed by the railways. It is therefore with some degree of surprise and no little admiration that one reads Mr. Fagan's book, which holds entirely different views.

J. O. Fagan is a remarkable man. A cable-layer and operator in South America in his youth, later a gold digger and a trader in the Transvaal, he became, over twenty years ago, a signal operator on a New England railroad. Except for short periods, when he was the chief clerk to a superintendent, he has spent the best part of his mature life as a towerman in the yards of Cambridge, Mass. All of this time he has been studying, from the inside, the railway industrial problem, and this book, first published as a series of papers in the "Atlantic Monthly," is a result of that study as it pertains to safety of railway operation. It is extremely well written, in a clear and forceful style, and must command the attention of the traveling public as well as the consideration of the railway man, however the latter may view the opinions of the author.

It is estimated by Mr. Fagan that "fully 85% of the fatalities that occur on our railroads can be directly traced to the negligence of employees." For this negligence the fault lies equally with the employee and with the management; with the former on account of his purely selfish views of his duties and obligations; with the latter because of its lack of control of the organization. In the early days of railroading the employee was under the absolute domination of the management; his rights were few and those little respected. In gradual revolt against this industrial slavery, labor unions were organized, which, step by step, forced recognition from the operators until at present the railway employee is one of the freest and most liberally treated of all labor's army. But this freedom brought with it the evils which are threatening the safety of railway travel; a feeling of personal superiority over rules on the part of the employee and a lack of discipline in enforcing those rules on the part of the management. Those regulations which are founded on obvious reasons, the trainman will readily observe, but when he comes to the point of choosing between his own judgment, based on limited observation, as against the (to him) non-comprehensible rules of the management, founded on general practice, it is generally the latter that go by the board. When the regulations have been broken and an accident ensues, the management, worried and threatened by the labor union, generally omits to make a public exposure of the negligent employee or of the carelessness back of the accident, but contents itself with a more or lesser effective personal and secret reprimand. And two weeks later the same error is again made by an employee who had not heard of the first.

In a word, then, according to Mr. Fagan, the mechanism is ahead of the man. How this is to be remedied the present book does not attempt to say, though the author is now publishing in the "Atlantic Monthly" a series of constructive articles to offset the destructive criticisms of his first book. If there is any solution to the problem it is, in the opinion of Mr. Fagan, to be found in the popular modern philosophy of loyalty. The labor leader must attempt the achievement of more than higher wages, he must instill in the men a sense of their responsibility toward themselves, their road and finally and most important, the people at large, for whom and, in the end, by whom the railway is managed. The management, on its part, must become more independent of the influence of the men. And the general resumé of the whole case, as well as the author's attitude toward his work, are best expressed in his own words:

> In the first place, it will be evident that the safety problem on American railroads must be taken in hand and solved by the people. The present tangled condition of affairs can be straightened out only by supreme authority.
>
> And our second conclusion is the revelation that the area in American industrial life covered by these preventable railroad accidents and the causes that lead up to them is practically, at the present day, a *terra incognita*. Of course the railroad man who steps out from the rank and file, and undertakes to give away the plans and topography of the country for the benefit of those who are interested in improving conditions, exposes himself to all sorts of cynical criticism in the minds of his fellows. However, as a matter of fact, your true philosopher thrives in this kind of atmosphere. He is born of the battle and the breeze, and spends a lifetime in fortifying the walls of his "tub," into which, when hard beset, he retires to enjoy himself.

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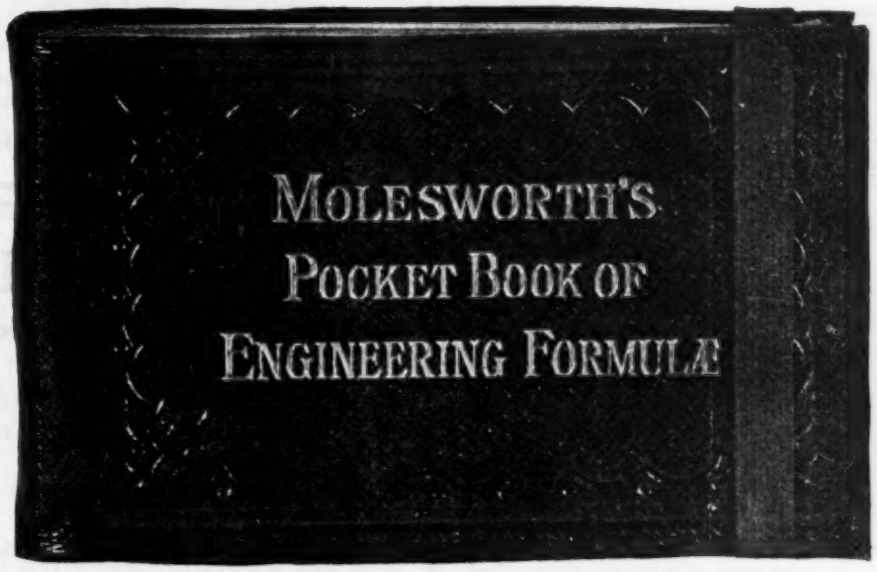

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Health Protective Work in New York State, 1907.

NEW YORK STATE DEPARTMENT OF HEALTH.—Annual Report for the Year Ending Dec. 31, 1907. (Eugene H. Porter, M. A., M. D., Commissioner.) In two volumes. Albany, N. Y.: Pub. Doc. Cloth; 5½ x 9 ins.; pp. 763 and 869; folding and other plates, and one folding map in pocket.

That a much-needed extension of the health-protective work of the great state of New York, both in scope and character, has at last been made, is evidenced by these two large volumes. The part that engineering plays in the work of any well-organized board of health is indicated by the fact that the larger of the two volumes is devoted to the Sanitary Engineering Division. The first volume, however, contains much information of interest and value to engineers as a class, while for any wide-awake person there is scarcely anything in either volume, from cover to cover, that would not prove interesting and instructive if only the average well-informed citizen had sufficient time to read such voluminous reports. For those who have not the time, the general review of the work of the Department, by Dr. Eugene H. Porter, Commissioner of Health, and some of the shorter reports, is available. Dr. Porter outlines the activities of all the branches of the Department during the year, and offers suggestions regarding needed future extensions of the work. Other features of the first volume deserving mention here are the special report on vital statistics by Prof. Walter F. Willcox, Consulting Statistician, of Cornell University, together with several papers presented at a conference of sanitary officers of the state; also, the report of Dr. Herbert D. Pease, Director of the Hygienic Laboratory. The last-named report contains a considerable amount of information based on examinations of municipal water-supplies of the state. Prof. Willcox's report on vital statistics is intended to serve as a digest and interpretation of the report of the Division on Vital Statistics which is given in the first volume. Valuable comments on estimating population are made by Prof. Willcox, and as a supplement to his report there is a discussion by Prof. James McMahon, of Cornell University, entitled "Method of Estimating the Present Value of the Net Prospective Earnings Lost by Deaths from Tuberculosis in New York State in One Year."

In the second volume, Mr. Theodore Horton, M. Am. Soc. C. E., Chief Engineer of the Health Department, takes up in succession the examination of plans for sewerage and sewage disposal during the year, investigations of sewerage and sewage disposal made in various localities, the protection of public water-supplies, including rules for the purpose, investigations of stream-pollution complaints and various other nuisances, and special investigations of the drainage areas of the Oswego, Mohawk and Genesee rivers. In addition, there are reports of inspections of the sanitary condition of the cities of Ogdensburg, Niagara Falls and Poughkeepsie, and of the sewage-disposal plants of the state, both municipal and private, and of summer resorts on Long Island and in the Catskills, and finally of ice harvesting on the Mohawk and Hudson rivers. The inspections of sanitary conditions in the three cities named were prompted by the unduly high typhoid rates in these and some of the other cities of the state. Further investigations of this sort will be made. The three reports in the present volume were prepared by Prof. H. N. Ogden, Assoc. M. Am. Soc. C. E, Special Assistant Engineer, of Cornell University

Perhaps the portion of the whole report which will be most gladly welcomed by engineers will be the 100 pages devoted to descriptions of the 29 municipal and 26 institutional sewage-disposal plants. This special report was also prepared by Prof. Ogden, but most of the descriptions were written by Mr. C. L. Walker, Special Engineering Inspector of the Department, who examined most of the plants described. This special report contains outline plans of various disposal plants, most of which are prepared from sketches made by Mr. Walker at the time of his visits to the plants. Many photographs taken by Mr. Walker are also given. The descriptions of the various plants give a good general idea of their character.

We cannot refrain from suggesting that the usefulness of these two volumes would have been increased had some of the matter been presented in more condensed form. It is always questionable, for instance, whether a state department is warranted in publishing, so fully as is here done, such proceedings as those of the sanitary conference reported in the first volume. It would also seem particularly advantageous to have cut down some of the correspondence pertaining to the approval of plans for proposed sewage disposal works. It is, of course, convenient to a state department to have all or a considerable part of such correspondence available for reference in printed form, but much of it is necessarily of local and temporary value, and it seems that some of it in this case might better have been left for the department files. The space thus gained could be well used, perhaps, to give more extended descriptions and fuller illustrations of sewage-disposal plants actually constructed.

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THE FINANCIAL HISTORY OF WISCONSIN.—By Raymond Vincent Phelan, Ph. D., Instructor in Economics, University of Minnesota. A Thesis Submitted for the Degree of Doctor of Philosophy, University of Wisconsin, 1906. Madison, Wis.: The University (Bulletin No. 193). Paper; 6 x 9 ins.; pp. 293. 50 cts.

In writing his Financial History of Wisconsin Mr. Phelan had to deal with a period of only seventy years (1836 to 1905), the first 12 of which related to territorial government and required only brief consideration. After reviewing constitutional provisions relating to finances, the author discusses the public debt, trust funds, the sale and management of State lands and the general financial administration of the State. The bulk of the volume deals with taxation. Under taxation of railways and other public-service corporations, is the material of most interest to our readers. In general, taxation of railways and the like was on the gross revenue basis until 1905, when it was changed to a cash-valuation basis, determined mostly from the market value of stock and bonds. The History makes no mention of the important part played by engineers in the valuation of public-service corporation property in Wisconsin, because it stops short of the date when most of that work was begun.

Educational Statistics

COMMISSIONER OF EDUCATION.—Report for the year Ended [illegible] 30, 1907. Vol. 2. Washington, D. C.: Pub. [illegible] Cloth; 5⅝ x 9¼ ins.; pp. 523 to 1,214; 184 tables.

A vast mass of statistics, with comparatively little text, is here given regarding the common schools, city schools, universities, colleges and technological schools, agricultural and mechanical colleges, professional schools, and a variety of other educational institutions of the country.

In the course of the introduction to the statistical tables, Prof. Edward L. Thorndike, of the Teachers' College, Columbia University, makes some interesting remarks, from which we quote a few paragraphs as follows:

I estimate that our account as a nation for the year 1906-7 stands somewhat as follows: We use in formal school education a material plant valued at from $1,200,000,000 to $1,300,000,000, the labor of 550,000 teachers or other educational officers, and more or less of the time of some 18,000,000 students, equivalent roughly to the time implied by 150 days' attendance on elementary school by 12,500,000 children, by a full year's work in a school of secondary grade by 1,000,000 boys and girls in their teens, and by a full year's work in a college, professional school, or other institution, by 200,000 young men and women.

We pay for the labor of these teachers, many of whom work for only part of the normal city-school year, about $300,000,000. We pay for fuel, light, janitorial services, repairs, depreciation of books, school supplies, insurance, and the like, about $90,000,000. For depreciation of the plant not so charged we should properly provide during the year a sinking fund of perhaps $25,000,000. Adding an interest charge of 5% on the investment in the plant and our annual bill for formal school education comes to over $475,000,000. Additions to the plant were made to the extent of from $90,000,000 to $100,000,000.

As a partial estimate of the returns from this investment we may take the number of students whose education has been carried to a specified standard of accomplishment and power. Thus I estimate that in 1907 3,000 students reached the standard denoted by three years or more of academic, technical or professional study in advance of a reputable college degree; that 25,000 students reached the standard denoted by at least three and not over four years of such study in advance of a four-year high school course; that 125,000 students reached the standard denoted by at least three and not over four years of study in advance of an eight-year elementary-school course; and that 750,000 students reached the standard of completion of an elementary-school course of seven or eight years or its equivalent.

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Small Tools.

Reviewed by WILLIAM W. BIRD.*

HANDBOOK OF SMALL TOOLS.—Comprising Threading Tools, Taps, Dies, Cutters, Drills and Reamers. Together with a Complete Treatise on Screw-Thread Systems. By Erik Oberg, Associate Editor of "Machinery," Author of "Shop Arithmetic for the Machinist." New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¼ x 8¼ ins.; pp. 517; 282 illustrations in the text, and 134 tables. $3; English price, 12s. 6d., net.

Small tools is a subject on which but little information is to be found in existing treatises on shop practice, and that little only in scattered articles. The author has brought together much of this scattering information and in addition presents a first-class view of modern practice gained by years of experience with one of the foremost small-tool manufactories in this country. The book is written for practical men, though theoretical considerations have not been overlooked.

Much space is devoted to tables, formulas, and general matter of service to the designer and the toolmaker. A large portion of the book is given over to screw threads and the methods of producing them. The information on this subject is very complete. The various screw-thread systems in general use are described in detail, together with their essential differences, advantages and disadvantages. In all, eight chapters are devoted to the various methods of producing threads with thread tools, chasers, taps and dies and the proper method of making these tools. In a book of this character which gives more or less of the history of the various screw-thread systems, Mr. Albert M. Powell, of Worcester, Mass., should have been given credit for the Achme thread.

Two chapters are given to milling cutters, one to reamers, and one to drills, counterbores, hollow mills and lathe arbors.

Under the heading, "Kind of Steel Used for Taps," the author remarks that "Ordinary Carbon steel or tool steel should be used for all kinds of taps." After spending so much time in getting together all of this material on taps, it is to be regretted that something more could not have been written with regard to the various kinds of tool steel and the amount of carbon best suited for taps.

In referring to drill tests made at the Worcester Polytechnic Institute the author states that 45° is the best angle for all drill points, but the report on these tests stated that this was only true for high-speed steel.

The author should also correct his statements regarding the A. S. M. E. standard machine screws. The American Society of Mechanical Engineers approved, but did not adopt, these standards.

The 134 tables and 283 illustrations given in this book, together with the fact that the book is well indexed, renders it valuable as a work of reference for any one connected with the machine shop. It is unquestionably the best book that has appeared on the subject of small tools.

*Professor of Mechanical Engineering and Director of the Washburn Shops, Worcester Polytechnic Institute, Worcester, Mass.

INDUSTRIAL EDUCATION.—The Annals of the American Academy of Political and Social Science. Issued Bi-Monthly. Vol. XXXIII., No. 1, January, 1909. Emory R. Johnson, Editor. Philadelphia, Pa.: The Academy (36th and Woodland Ave.). Paper; 7 x 10 ins.; pp. 224. $1 per number.

BEGINNINGS IN INDUSTRIAL EDUCATION.—And Other Educational Discussions. By Paul H. Hanus, Professor of the History and Art of Teaching in Harvard University. Boston and New York: Houghton Mifflin Co. Cloth; 4¾ x 7½ ins.; pp. 199. $1, net.

It is a significant sign of the times that demands are now being made in almost every quarter for material changes in the education of the youth of the land. Much information on this subject is contained in the two publications noted above. The "Annals" for January contains 23 essays on industrial education, mostly descriptive of industrial or trade schools which have been in operation for periods ranging from a considerable number of years to a few months. These descriptions include schools at Columbus, Ga., Springfield, Mass., New York, Philadelphia, Milwaukee, and Manila, P. I., under public direction, besides a number of schools connected with private business enterprises, such as those of the General Electric Co. at West Lynn, Mass., and the Store School of John Wanamaker, in Philadelphia.

The leading essay is on the "Relation of Industrial Education to National Progress" and is by Mr. Booker T. Washington, Principal of the Tuskegee Institute, Ala. Col. Carroll D. Wright reviews "The Work of the National Society for the Promotion of Industrial Education." Prof. Herman Schneider, Dean of the College of Engineering, University of Cincinnati, writes of "Partial Time Trade Schools." The attitude of labor unions to industrial education, according to statements by Mr. John Golden, President of the United Textile Workers of America, Fall River, Mass., is far more sympathetic than is generally understood. What the unions object to, according to Mr. Golden, is not industrial education, but the sort of schools which are established chiefly for providing low-waged and incapable substitutes for trained workmen or for supplying strike breakers.

The small book by Prof. Hanus, noted above, contains a number of essays on industrial education, but the busy man will find the meat of these essays in the first one, which gives title to the volume. In this first essay, the general problem of industrial or vocational education is well stated. The problem is, and it may be noted that the author agrees in general with the writers of the many essays in the "Annals," not only to train boys and girls for life work with their hands, but also to bridge over and profitably utilize the time of boys and girls between the ages of, say, 14 and 17, when their services in shops and factories are not wanted as a rule, owing to their immaturity. The result is that boys and girls of this age who drop out of the ordinary school, as is the case of perhaps 90% of school-children, are unable to find anything to do which really contributes toward their training for progress in the arts or industries. They earn comparatively little money, and forget nearly all they have learned during their school-days. The aim of the industrial or vocational school is to keep the boy and girl learning for two or three years beyond 14, taking up chiefly training of the hand and eye in industrial occupations, but not neglecting the so-called cultural studies.

The results of the investigations of the Massachusetts Industrial Commission are set forth in Prof. Hanus' book. Besides the essays noted, this book contains one on the Industrial Continuation Schools of Munich and several on other phases of secondary education.

Publications Received.

THE ECONOMY FACTOR IN STEAM-POWER PLANTS.—By George W. Hawkins. New York: Hill Publishing Co. Cloth; 6 x 9½ ins.; pp. 133; 49 illustrations, partly in the text, and numerous tables. $3, net.

ENTWURF EINES WASSERKRAFTWERKES IM GEBIET DER MURG OBERHALB FORBACH.—By Th. Rehbock, Professor in the Grand-ducal Technical College "Fridericiana" at Karlsruhe. Leipzig, Germany: Wilhelm Engelmann. Stiff paper; 8¼ x 13 ins.; pp. 47; 22 plates and 2 text illustrations. 8 marks; American price. $3.20.

ETUDE SUR L'AVIATION.—By Maurice de Cantelou. Paris, France: Ch. Béranger. Paper; 6½ x 10 ins.; pp. 128; 45 illustrations in the text.

DIE FORTSCHRITTE AUF DEM GEBIETE DER ELEKTRISCHEN FERNBAHNEN.—Erfahrungen und Aussichten auf Grund von Betriebsergebnissen. By O. C. Roedder. Wiesbaden, Germany: C. W. Kriedel. Stiff paper; 7¼ x 10¾ ins.; pp. 323; 172 illustrations, mostly in the text. 12.60 marks; American price, $5.

FOUNDRY PRACTICE.—A Treatise on Molding and Casting in Their Various Details. By James M. Tate and Melvin O. Stone. Prepared for the Use of Students in the College of Engineering, University of Minnesota. Third edition, revised. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 4¾ x 7½ ins.; pp. 234; 112 illustrations in the text. $2; English price, 8s. 6d., net.

GEOLOGIC ATLAS OF THE UNITED STATES.—U. S. Geological Survey, George Otis Smith, Director. No. 160: Accident-Grantsville Folio, Maryland-Pennsylvania-West Virginia. Washington, D. C.: Pub. Doc. Paper; 18½ x 21¾ ins.; pp. 14; nine plates.

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ILLUSTRATED TECHNICAL DICTIONARY.—In Six Languages: English, German, French, Russian, Italian, Spanish. Edited after a novel method by K. Deinhardt and A. Schlomann, Engineers. New York: McGraw Publishing Co. London: Archibald Constable & Co., Ltd. Munich-Berlin: R. Oldenbourg. Paris: H. Dunod & E. Pinat. St. Petersburg: K. L. Ricker. Milan: Ulrico Hoepli. Madrid: Bailly-Bailière é Hijos. Cloth; 4 × 7¼ ins.

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INDUSTRIAL ACCIDENTS.—MEXICAN LABOR IN THE UNITED STATES.—Bulletin of the Bureau of Labor, No. 78, September, 1908. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 417 to 644.

THE INTERNAL COMBUSTION ENGINE.—Being a Text Book on Gas, Oil and Petrol Engines, for the Use of Students and Engineers. By H. E. Wimperis, Assoc. M. Inst. C. E., Assoc. M. Inst. E. E., Whitworth Scholar. New York: D. Van Nostrand Co. Cloth; 5⅛ × 8¼ ins; pp. 326; 114 illustrations in the text. $3, net.

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IRRIGATION IN WYOMING.—By Clarence T. Johnston, State Engineer. Prepared under the direction of Samuel Fortier, Chief of Irrigation Investigations. Bulletin 205, Office of Experiment Stations; A. C. True, Director. Washington, D. C.: Pub. Doc. Paper; 6 × 9 ins.; pp. 60; 3 plates and 22 text figures.

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LEHRBUCH DES TIEFBAUES.—Edited by Karl Esselborn. Third edition, enlarged. Vol. II.: Grundbau, Brückenbau, Wasserversorgung und Entwässerung der Städte, Wasserbau. By Karl Esselborn, Theodor Landsberg, Eduard Sonne and Leo v. Willmann. Leipzig, Germany: Wilhelm Engelmann. Paper; 7½ × 11 ins.; pp. 524; 1,800 illustrations in the text. 15 marks; American price, $6.

LOSSES OF IRRIGATION WATER AND THEIR PREVENTION.—By R. P. Teele, Expert in Irrigation Institutions, Office of Experiment Stations. (Reprint from Annual Report of the Office of Experiment Stations for the Year Ended June 30, 1907.) Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 369 to 386; four illustrations in the text.

MINERAL RESOURCES OF THE UNITED STATES.—Calendar Year 1907. U. S. Geological Survey, George Otis Smith, Director. In two parts. Washington, D. C.: Pub. Doc. Cloth; 5¾ × 9 ins.

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NATIONAL COUNCIL OF COMMERCE.—Proceedings of the First Annual Meeting, Held at the Office of the Secretary of Commerce and Labor, Dec. 10, 1908. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 28.

NATIONAL FIRE PROTECTION ASSOCIATION.—Quarterly, Vol. II., No. 3, January, 1909. Hartford, Conn.: Henry A. Fiske, Editor (P. O. Box 1284). Paper; 6¾ × 9 ins.; pp. 271 to 389; illustrated. $1 per copy.

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REPORT ON THE MINING AND METALLURGICAL INDUSTRIES OF CANADA, 1907-8.—Eugene Haanel, Ph. D., Director Mines Branch, Department of Mines, Ottawa, Canada: Pub. Doc. Paper; 6⅛ × 9⅝ ins.; pp. xvi. + 972; numerous folding and other plates, 20 drawings and 6 maps. $1.

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STATE ENGINEER (South Dakota).—Biennial Report to the Governor, for the Years 1907-1908. (Samuel H. Lea, State Engineer.) Pierre, S. Dak.: Pub. Doc. Cloth; 6 × 9 ins.; pp. 208.

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TAX COMMISSIONER, STATE OF TEXAS.—Annual Report for the Year 1908. L. T. Dashiell, Commissioner. Austin, Tex.: Pub. Doc. Paper; 6 × 9 ins.; pp. 105.

THE TRAFFIC OF THE SUBWAY OF THE INTERBOROUGH RAPID TRANSIT COMPANY OF NEW YORK CITY.—Submitted to the Public Service Commission for the First District of the State of New York by Bion J. Arnold, Special Consulting Engineer. Report No. 6, Dec. 31, 1908. New York: Public Service Commission. Paper; 6¾ × 10 ins.; pp. 69; 46 illustrations in the text, and 3 folding plates.

THE USE OF SMALL WATER SUPPLIES FOR IRRIGATION.—By Samuel Fortier, Chief of Irrigation Investigations, Office of Experiment Stations. (Reprint from Yearbook of Department of Agriculture for 1907.) Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 424; six illustrations in the text.

WATER POWER ENGINEERING.—The Theory, Investigation and Development of Water Powers. By Daniel W. Mead, M. Am. Soc. C. E., Consulting Engineer, Professor of Hydraulic and Sanitary Engineering, University of Wisconsin. New York: McGraw Publishing Co.. Cloth; 6 × 9¼ ins.; pp. 787; 413 illustrations, mostly in the text, and 89 tables. $6.

WEATHER BUREAU.—Report of the Chief, 1906-1907. (Willis L. Moore, Chief.) Washington, D. C.: Pub. Doc. Cloth; 8¾ × 11¾ ins.; pp. xliii. + 402.

THE YOUGHIOGHENY IMPROVEMENT.—Compiled and Edited by W. G. Armstrong, Secretary Chamber of Commerce of Greater Connellsville. Connellsville, Pa.: The Editor. Paper; 5¾ × 9 ins.; pp. 58.

ZEITUNGS-KATALOG DER ANNONCEN-EXPEDITION RUDOLF MOSSE, 1909.—42d edition. Hamburg, Germany: Rudolf Mosse. Cloth; 8 × 11½ ins.; pp. xxxii. + 264 + 372. Separately bound diary of 80 pages, containing also revised laws for drafts, checks and postal money orders, and coin and interest tables.

ENGINEERING LITERATURE

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EDITORIAL

A reviewer of a recent American book on sewage treatment appears to be surprised because he did not find in the book "any description of the aphidian distributor in common use in England." Certainly the omission is surprising and unfortunate. If such distributors are, as the reviewer states, "in common use in England," we see no reason whatever why the entomologists of this country should not be set at once to training our own myriads of aphides to the task of sewage distribution, thus converting a pest into a blessing. This done, we should look for an establishment of sewage farming here on as extensive a scale as was ever practiced in the palmiest days of that art in England. The most promising line of development would seem to be fruit plantations. Here the aphides required for distributing the sewage would be grown on the trees, and the time and strength which they would have to devote to distributing the sewage would perhaps be sufficient to so diminish their voraciousness as to give the trees a fair chance of healthful growth. Any sapping of the energy of the trees would be made up by the fertilizing value of the sewage and by preventing injury to the trees through drought. Before any of our readers launch any ventures in accordance with the possibility just outlined, we would suggest that they make sure whether this aphidian distributor was not evolved in the brain of some stenographer, who misunderstood the reviewer when he dictated the word "Fiddian," which is the trade name of one of the many British sewage distributors. There is just a possibility that this was really what the reviewer had in mind, and that by some chance he failed to revise his typewritten "copy" and did not see proof of his review before it was printed.

An interesting pen picture of the introduction of macadamized roads in a rural district of England, with glimpses of a remarkably genial and self-sacrificing surveyor, has given the editor so much pleasure during several readings and rereadings that he ventures to reprint it here for the benefit of those who may not have seen it in its original setting. The picture is taken from "Our Village," a series of charming essays on rural life, scenery and character, by Mary Russell Mitford, which appeared at intervals from 1819 to 1832. The first complete edition of these essays appeared in 1843. We quote from one of the handy volumes in the (Dent and Macmillan) "Temple Classics." For the better understanding of the opening sentence it may be stated that this pen sketch appears in an essay called "A Parting Glance at Our Village." The author says:

The only real improvement with which we have been visited for our sins—(I hate all innovations, whether for better or worse, as if I was a furious Tory, or a woman of threescore and ten)—the only misfortune of that sort which has befallen us in under foot. The road has been adjusted on the plan of Mr. Macadam; and a tremendous operation it is. I do not know what good may ensue; but for the last six months some part or other of the highway has been impassable for any feet, except such as are shod by the blacksmith; and even the four-footed people who wear iron shoes make wry faces, poor things! at those stones, enemies to man and beast. However, the business is nearly done now; we are covered with sharp flints every inch of us, except a "bad step" up the hill, which, indeed, looks like a bit cut out of the deserts of Arabia, fitter for camels and caravans than for Christian horses and coaches; a point which, in spite of my dislike of alteration, I was forced to acknowledge to our surveyor, a portly gentleman, who, in a smart gig, drawn by a prancing steed, was kicking up a prodigious dust at that very moment. He and I ought to be great enemies; for, besides the Macadamite enormity of the stony road, he hath actually been guilty of tree murder, having been accessory before the fact in the death of three limes along the rope-walk—dear, sweet, innocent limes, that did no harm on earth except shading the path! I never should have forgiven that offense, had not their removal, by opening a beautiful view from the village up the hill, reconciled even my tree-loving eye to their abstraction. And, to say the truth, though we have had twenty little squabbles, there is no bearing malice with our surveyor; he is so civil and good-humored, has such a bustling and happy self-importance, such an honest earnestness in his vocation (which is gratuitous, by-the-bye), and such an intense conviction that the state of the turnpike road between B. and K. is the principal affair of this life, that I would not undeceive him for the world. How often have I seen him in a cold winter morning, with a face all frost and business, great-coated up to the eyes, driving from post to post, from one gang of laborers to another, praising, scolding, ordering, cheered, laughed at, and liked by them all! Well, when once the hill is finished, we shall have done with him forever, as he used to tell me by way of consolation, when I shook my head at him, as he went jolting along over his dear new roads, at the imminent risk of his springs and his bones; we shall see no more of him; for the Macadam ways are warranted not to wear out. So be it; I never wish to see a road-mender again.

The curious may like to know that "Our Village" was Three Mile Cross, between Reading and Basingstroke. Here Miss Mitford took up her residence in 1820. Presumably, but we are not at all sure, this essay was written shortly after that date.

CORRESPONDENCE.

Comments on Review of "Australasian Roads."

Sir: In the notice of "Australasian Roads," appearing in your issue of Oct. 15, 1908, your reviewer makes it appear that drivers of four and six-horse teams can command in Australasia 75 cts. and $1.05 per hr., respectively. Lest this, appearing in your widely-read paper, should mislead, we desire respectively to point out that these sums include the provision of horses and harness, as well as drivers' wages, as will appear from a perusal of the table as printed in the book; at any rate the context would make this clear to any one who read the chapter. In quoting this table, your reviewer has altered it: had he not done so, we would have trusted to the intelligence of your American teamsters, and would not have troubled you with this communication.

Yours faithfully,
J. M. and H. E. Coane.

70 Queen St., Melbourne, Jan. 14, 1909.

[The foregoing letter having been submitted to Mr. Samuel Whinery, M. Am. Soc. C. E., author of the review in question, Mr. Whinery states that the figures in question were based on statements made in brief tabular and text matter. The only reference to rate of wages in the text is the following sentence: "Wages for various classes of labor have been allowed for as scheduled in Table VI." Mr. Whinery comments on the use of the word "with" in the last four entries in the table, as follows:

The use of "with" in the sense in which the authors evidently intended, is unusual in this country and I assumed it to be equivalent to "in connection with." Had "and" been used by the authors in place of "with," the meaning would have been obvious. The customary phrase here would be "Four-horse team and driver," etc.

The table mentioned is reproduced herewith.

AVERAGE AUSTRALASIAN RATES OF WAGES, SUBJECT TO MODIFICATIONS ACCORDING TO LOCALITY AND CONDITIONS.

Class of labor.	Wages per day of eight hours.	Wages per hour.
Laborer, scavenger, and sweeper..	7/-	-/10-1/2
Foreman laborer	7/6	-/11-1/4
Pitcher setter	9/-	1/1-1/2
Carpenter	10/-	1/3
Steam roller driver.....	10/-	1/3
Driver laborer, with horse in cart, watercart, scraper or sweeping machine	11/-	1/4-1/2
Driver laborer, with two horses in wagon, watercart, roller or scoop	15/-	1/10-1/2
Driver laborer, with four horses in wagon, roller, road machine or other implement.....	25/-	3/1-1/2
Driver laborer, with six horses in roller, road machine or other implement	35/-	4/4-1/2

The wage figures given in the table indicate shillings and pence: about 25 cts. to the shilling and 2 cts. to the penny.—Ed.]

REVIEWS.

The Water-Power End of Hydro-Electric Engineering.

Reviewed by F. C. FINKLE.*

WATER POWER ENGINEERING.—The Theory, Investigation and Development of Water Powers. By Daniel W. Mead, M. Am. Soc. C. E., Consulting Engineer, Professor of Hydraulic and Sanitary Engineering, University of Wisconsin. New York: McGraw Publishing Co. Cloth; 6 x 9¼ ins.; pp. 787; 413 illustrations, mostly in the text, and 80 tables. $6.

The above-named work is devoted to the theory and practice of developing water-powers. While it is designated as a general treatise on the subject, the text is limited to a consideration of water-power developed in connection with electric plants. This branch of water-power development is somewhat different from that under which the hydraulic power is applied directly to industrial machinery. It involves the infinite considerations arising from the conversion of the hydraulic into electrical energy, and its distribution throughout extensive districts for manifold uses. It has become known in the technical world as Part I. of Hydro-Electric Engineering.

The book opens with a chapter on the history of appliances for utilizing the potential energy of water, which carries the chain of progress in this branch up to the invention of the reaction turbine. As the range of usefulness of the reaction turbine is limited to a certain set of conditions, the story might properly have been completed by adding the narrative of how the impulse turbine, which fits the other set of conditions, was invented and successively perfected. The next chapter is a very good presentation of the physics of energy, with a statement of the re-

*Consulting Engineer, 230-231 I. W. Hellman Bldg., Los Angeles, Cal.

lations between the conventional units adopted for the measurement of energy.

Chapter III. treats of the hydraulics of canals, pipes, weirs and some kinds of orifices. The treatment is incomplete, as it does not include the laws governing the effect of bends, curves, gates, changes of section, etc., in canals and pipes. Nor does it include any analysis of the rules governing the flow through nozzles, Ys, branches in main canals and pipes, etc. A still more important omission is the failure to discuss the relation of hydraulics to the materials of which canals and pipes may be constructed. This is one of the most important phases of hydraulics, as it is incumbent on the engineer to select such materials for use in constructing conduits as will withstand the velocity and other destructive attributes of the water to be carried by them. In presenting the formulas of flow in such a work one should be careful to discriminate by giving the derivation and applicability of each to various conditions. Either this is necessary, or only one formula should be given, in order not to confuse the student and young engineer. Sufficient is said in the book to distinguish between the use of Kutter's and Bazin's formulas for flow in open channels, but this is not true regarding the nine formulas for flow in pipes, given in Fig. 25. The reviewer believes in an exponential formula like that of Tutton, but does not ignore the fact that some others of more involved structure give nearly as close results. Nevertheless it must be asserted that some formulas, like that of Sullivan,* are unsound theoretically and give results at variance with experimental data.

Chapters IV. and V. are to be highly commended for the comprehensive manner in which the power available from streams is treated. The use of hydrographs for solving these classes of problems has long been employed by the reviewer in his practice, and he can heartily commend this method to his co-laborers in the profession. At the same time it must be understood that the term "hydrograph" is a very general expression, and should not be used in the text, as is done in Articles 49 to 54 of this book, without some qualifying adjective, as for example "discharge hydrograph," "storage hydrograph," "rating hydrograph," etc.

Chapters VI. to XI., inclusive, should have preceded Chapters IV. and V. for the sake of logical arrangement. It would seem that the rules for ascertaining the flow of streams should precede those relating to stream hydrographs and stream-power diagrams, since the latter are based on stream discharges, whether these are from actual gagings or derived from other indirect data by interpolation. As remarked by the author himself, on page 82, "it is rare that observations of stream flow for a long period of years are available at the immediate site of the proposed power plant." Hence the necessity for acquainting the student with the methods by which stream flows may be approximated from rainfall, run-off on similar drainage areas, geological examinations, ratios obtained from fragmentary data, etc., before he proceeds to construct hydrographs and power diagrams.

Barring this defect in arrangement all of these chapters are very good. Attention may be called, however, to the statements regarding "the water year" in Articles 77 and 90. It is there stated that "December to May is termed the 'Storage' period, June, July and August constitute the 'Growing' period, and September, October and November the 'Replenishing' period." This statement is general, but such is not the fact in all parts of the United States. It is only true in sections, where the climate is similar to that of the North Atlantic and Middle Western states. It does not apply in the Rocky Mountain region, because precipitation in sufficient quantity to cause replenishment and stroage cannot be relied on until January, and the year should be divided into two periods, "storage" from January to May and "draft" from May to January, during which period the main supply of water is from previous natural storage, which is but slightly augmented by precipitation.

In the greater part of the Southern states no periods can be designated as the "water year," except on streams rising in the North and flowing through the South, as the precipitation occurs in the form of pretty evenly distributed rainfall. In the Pacific Northwest the period from November to June may be termed "storage" and from July to October "draft," while in California these two periods are from December to March "storage" and April to November "draft."

With Chapter XII., which is a good history of turbine development in the United States, the author begins the second part of his work: that is, the exposition of principles relating to the design and construction of power plants on streams. The chapter following this deals in a very satisfactory manner with many important details of turbine design, such as bearings and regulating gates. Other matters of detail are merely mentioned, as for instance draft tubes, for which no information regarding proper length, diameter and taper is given.

Wrecked Force Main of Animas Power and Water Co., of Durango, Colo.

(The break was caused in September, 1906, by water hammer due to the action of the by-pass needle nozzle under short circuits from transmission line.)

Chapter XIV., it seems to the reviewer, gives but partially and imperfectly the theory of turbine hydraulics. This the author admits in Article 148, wherein he states:

> It is not the purpose of this chapter to consider mathematically and at length the principles of hydraulic flow in relation to the curves of guides and buckets and the effects of such curves on the power and efficiency of the turbine.

Figs. 203, 204 and 207 are so incomplete and imperfectly drawn, that they are of little value as an aid to understanding the text and grasping the principles involved in turbine hydraulics. The whole chapter is principally valuable for instructing an engineer how to work from some established and tested standard and for making comparisons between different types of American turbines. It neither furnishes any guide for independent designing nor imparts any knowledge from which it may be determined why certain efficiencies result when testing turbines.

Chapter XV. gives in detail and very clearly and concisely the methods employed for testing turbines to determine their efficiency and other characteristics. Following in the next chapter is a discussion on the selection of a turbine for any particular case. Viewed from the standpoint of securing something about as good as that possessed by one's predecessors, the analysis given is a good one. B[y] considering the many defects and inconsisten[cies] found in a great majority of the turbines n[ow] in use, it is to be questioned whether such [a] rule is the proper one to follow.

It is an undisputed fact that t[he] design of hydraulic turbines in this countr[y] has been largely by the "cut and try" met[hod] one designer blindly following his for[mer] and adopting such changes only as re[sult]ed trials have demonstrated to be advisable. This practice should be discouraged by eng[ineers] as it is seldom that two conditions are e[nough] alike to warrant copying. European en[gineers] and many American engineers as well hav[e] long since recognized this to be true, and h[ave] applied scientific principles to their designi[ng]. A correct mathematical solution of the p[ro]blems involved is the only safeguard against failures in hydraulic-turbine installations. Th[e] turbine must be considered as a part of one mechanical unit, the power plant, and especially designed to fit all the conditions of the whole. When all these conditions and factors are known and understood by the engineer, he can by careful mathematical analysis determine in advance of ordering a turbine what should be its speed, the form of guides, nozzles, buckets and draft tubes, the materials of which each part is made, etc. This, it is true, leads to very complicated and long equations in mathematics or to intricate and almost endless graphical solutions.

However, it is better to undertake such a careful and searching investigation *a priori*, than to have the imperfections, failures and renewals which so often accompany attempts to solve the same problems by copying something else, or by the "cut and try" process. Were it necessary to strengthen this argument by practical illustrations, this could be done by citing numerous examples of plants where such hydraulic turbines have been replaced and are being replaced almost as soon as the beginning of operation.

Chapter XVII. treats of a very important matter relating to power plants, namely the load factor, and the information and suggestions given are all good and timely. It is to be regretted that this is a matter about which engineers are seldom consulted by power-plant managers, although it is strictly an engineering problem.

In Chapter XVIII., taken in connection with Appendices A, B, and C, are found some of the most valuable data in the volume, as they bear on the subject of regulating hydraulic turbines, which subject has been less perfectly understood by engineers than any other part of hydro-electric engineering. While commending the manner in which the subject has been treated the following remarks may be pertinent: From experience with air chambers the reviewer believes that they are of much value in preventing the rupture of penstocks and long force mains, whose factor of safety is not high enough to withstand the full impact of severe water hammers. But it is not demonstratable that they are of any material assistance in securing good regulation, and the surge tank of Dr. Raymond D. Johnson, which is merely a greater air chamber, cannot be expected to produce that result. The regulation of tangential impulse plants, having long force mains, is most satisfactorily accomplished by deflecting the nozzle, and having a supplemental and slower regulating device for changing the position of the needle valve in the nozzle.* Only in this way can the danger incident to surges and oscillatory waves in the force main be avoided and a saving of water affected at the same time. The use of the stationary by-pass nozzle for such cases is dangerous, as under the action of swinging short circuits on the transmission line the rapid alternations of needle movement and consequent reversal of flow through the two opposing nozzles has a tendency to so multiply the frequency of water-hammer pressure waves as to cause harmony with the vibration period of the pipe and thus create a destructive accumulation of pressures. This is what happened to the plant of the Animas Water & Power Co.,

*Engineer and Contractor, San Francisco, Vol. III, No. 2, pp. 10 and 11, and Vol. III, No. 3, p. 20.

near Dura[illegible], Colo., in September, 1906, when the force [illegible] was destroyed by water hammer. (See reproduction of photograph herewith.)

Equation 41 $\left(\delta = 294{,}000 \frac{R \times \Delta K}{I S^2}\right)$

and

42 $\left(I = 294{,}000 \frac{R \times \Delta K}{\delta S^2}\right)$

given on page 463, are undoubtedly sound mathematically, but the difficulty in estimating the value of R makes them of doubtful practical value. The following equations given by the reviewer* are easier to apply:

$$\delta = 800{,}000 \frac{N T}{r^2 \Sigma W R^2}$$

and

$$\Sigma W R^2 = 800{,}000 \frac{N T}{\delta r^2}$$

in the case of reaction turbine plants with water-saving by-pass, the value of T being fixed by the calculated time required for accelerating the water in the force main. (Note that with the exception of δ the characters in the two sets of equations are different.)

In order to protect themselves, even when engineers do not protect their customers, manufacturers of water-wheel governors should insist on the kind of specifications recommended in Art. 231 of Prof. Mead's book.

Chapters XIX. to XXII., inclusive, dealing with safety devices, construction details and illustrations of constructed plants, are interesting and instructive. All safety relief devices, however, should be fully explained to students and understood by engineers, as an understanding of the mechanics of such devices is necessary to their proper and safe use. Likewise great flexibility should attach to all directions regarding the arrangement of the turbine units in a station, since special conditions encountered in each individual case require departure from any fixed rule. Foundations should be of masonry or concrete for all permanent plants, unless the excavations are in bed rock, which will hold anchor rods. The water-power plants cited as examples are mostly of the reaction-turbine type with low hydraulic heads, but the references to literature at the end of the chapter cover all possible conditions.

Chapters XXIII., XXIV. and XXV., if considered by themselves, are far too brief for the importance of the subjects treated. Of course the literature cited covers the subjects of head races, dams and appendages for dams, but it requires time to consult so much scattered information, and for engineers and students located in small and remote communities the literature cited is seldom available. It may be questioned if a work of this kind should not contain more data relating to head races or feeder conduits, particularly in this day when water must be carried for long distances to make a fall available, and also in regard to dams, in the design and construction of which much advance has taken place recently.

The chapter on pondage and storage is far too incomplete. There should be a sharp distinction made between storage and regulating reservoirs, the former being intended to equalize the stream flow and the latter to accommodate the plant load factor and supply water during breaks in the feeder conduit.

In irrigated sections both primary and secondary reservoirs are often necessary to avoid conflicts with irrigation rights, and this is a very important matter in many localities.† The question of storage also involves many considerations arising from the daily, monthly, yearly and secular fluctuations of streams and the load curve, both present and future, of the proposed water-power plant. These can best be solved graphically by the construction of hydrographs to show the results of storage and draft with the reservoir capacities available and the demands on the power plant. Such compilations as those given in Table XXXIX. may form a part of the chain of figures from which hydrographs can be constructed, but should never be considered the final form for presentation in a report or its appendix.

The author's suggestion that a report be brief, stating only the necessary information and conclusions concisely, and that all explanatory matter, maps, profiles, tabulations, hydrographs, etc., should be submitted in an appendix, will be concurred in by engineers as well as capitalists. This arrangement results in a saving of time to busy men who have occasion to examine a report. In making reports on power projects it should also be remembered that the cost per horse power of capacity in the plant is not so important as it once was. This used to be the criterion when power was sold on a flat-rate basis, but with the general use of meters a different condition has arisen. The true test of the commercial value of a water-power plant is now what it can deliver kilowatt hours to the customers for, their load curve being considered. Thus a plant's flexibility in supplying power, its annual depreciation, cost of maintenance and reliability without auxiliary power plants are more important than the mere fact that its cost of construction is a fixed amount per horse power or kilowatt of capacity at 100% load factor. The reviewer believes that only the third method given on page 672 is the correct one for computing the value of an hydro-electric plant. The first seems impossible of application, owing to the difficulty of placing a value on water rights, and the second is unreliable because the earnings of a property are often affected by adverse temporary circumstances, while a comparison with the best possible competitor can always be made, if the facts are carefully and impartially considered.

In addition to the things considered important in a report, as stated by the author on pp. 683 and 684, the following may be added:

(1) Cost of power per KW.-hr. from proposed plant delivered to probable consumers.

(2) Cost of power per KW.-hr. from other plants, existing or possible, delivered to the same consumers.

(3) A description of the works proposed to be constructed sufficiently complete to permit the determination of probable depreciation on the plant.

(4) A careful estimate of all annual fixed charges.

Space prevents discussion of many other matters scarcely less important, but in conclusion it is proper to acknowledge the value of Prof. Mead's work by saying that his book should be found in the library of every hydraulic engineer; that it is a valuable work of reference for engineers generally; and that students of water-power engineering can profit by its liberal use in their course of study.

*See Engineering News, Vol. 60, No. 26, Dec. 24, 1908, p. 710.

†Trans. Am. Soc. C. E., Vol. XXXIV., + No. 7, pp. 1,028 to 1,035. Irrigation, an Informal Discussion at Annual Convention Am. Soc. C. E., June 25, 1908.

Aerial Navigation.

ARTIFICIAL AND NATURAL FLIGHT.—By Sir Hiram S. Maxim. London and New York: Whittaker & Co. Cloth; 5½ × 8¾ ins.; pp. xv. + 166;; 95 illustrations in the text. $1.75, net.

This book is essentially Sir Hiram Maxim's views and experiences in the art and science of aerial navigation. The reader will not for long forget that it is Sir Hiram who writes, so manifest is the author's personality. The book is enlivened by passages like the following, taken from Chapter I.:

I do not wish this little work to be considered as a mathematical text book. . . . During the last few years a considerable number of text books have been published. These have, for the most part, been prepared by professional mathematicians who have led themselves to believe that all problems connected with mundane life are susceptible of solution by the use of mathematical formulae, providing, of course, that the number of characters employed are numerous enough. When the Arabic alphabet is not sufficient, they exhaust the Greek also, and it appears that both have to be supplemented sometimes by the use of Chinese characters. As this latter supply is unlimited, it is evidently a move in the right direction.

The introductory chapter deals in a general way with the work of the author and of the other early experimenters. After this part, the flight of birds and kites is discussed and then follows the part really important to students of aeronautics—the account of the author's early experiments with screws and supporting aeroplanes. These are both interesting and instructive and present data that probably have never before been made generally available.

Another interesting and historically valuable part of the book is Appendix II.: a résumé of the early experiments on the famous steam-driven machine which was wrecked in 1894.

The book also contains what the author terms "hints in building flying machines," which are really in the nature of theoretical suggestions rather than tried-out designs. There are a few pages on a gyroscopic regulation of the vertical stability of an aeroplane and very brief descriptions of a few of the latter-day, "heavier-than-air" machines and dirigible balloons.

ETUDE SUR L'AVIATION.—By Maurice de Canteiou. Paris, France: Ch. Béranger. Paper; 6½ × 10 ins.; pp. 128; 45 illustrations in the text; 6 francs; American price, $1.80.

This book is a scientific discussion and analysis of the mechanical and other principles governing and relating to the art of aviation or flying with machines heavier than air. It contains no descriptions or views of flying machines, but is essentially mathematical and is in consequence full of formulas, diagrams of forces, and similar matter. The author divides the machines of this class as follows: (1) orthopters, or mechanical birds, having moving wings; (2) aeroplanes (with and without motors); (3) helicopters, having screws on vertical shafts to raise and screws on horizontal shafts to propel the machines; (4) machines combining features of the other classes. He describes "aeronautics" as relating to the navigation of the air by means of any kind, but generally restricted to machines lighter than air.

The book then takes up in detail the mechanical principles of the four classes of machines heavier than air, as noted above. It is pointed out, however, that while the figures and formulas can be used on the broad lines of a preliminary design they are more or less tentative. Such investigations must be accompanied by actual experiments. Each class of machine is considered as presenting certain advantages of its own, and it is claimed that all of them can be employed in military work.

Radiotelegraphy and Radiotelephony.

AN ELEMENTARY MANUAL OF RADIOTELEGRAPHY AND RADIOTELEPHONY.—For Students and Operators. By J. A. Fleming, M. Inst. E. E., Pender Professor of Electrical Engineering in the University of London, Professor of Electrical Engineering in University College, London, etc. London, New York and Bombay: Longmans, Green & Co. Cloth; 5¾ × 9 ins.; pp. 340; numerous text illustrations. $2, net.

Prof. Fleming has prepared this book as a preliminary manual, in the study of principles and appartaus, leading to a better appreciation of his larger and more mathematical work, published in 1906. An elementary knowledge of electrical phenomena is presupposed in the reader.

As an easy introduction to electrical wave phenomena, oscillations of current are explained by the analogies of mechanical actions. The properties of electrical circuits—resistance, inductance and capacity, are qualitatively discussed with particular reference to the effect of high potential and high frequency currents.

Apparatuses for the production of electrical oscillations are described in two groups. The first contains all those for generating effects that quickly die out. The second group shows chiefly the generators that have been built for directly producing, from mechanical power, a low-tension current of frequencies up to 80,000 cycles per sec. This part also shows the development of a method of obtaining undamped oscillations of current, of very high frequency, by shunting a direct-current arc by a circuit containing proper capacity and inductance.

One long chapter is interposed on Maxwell's proposition that "the luminiferous ether must be identical with the hypothecated electro-magnetic

medium." This discussion leads up to the formation of a mental picture of the production of Hertz waves through the air, or ether. After this there are outlined the properties of circuits necessary that electrical and magnetic ether waves may be received and radiated. Several notable arrangements of aerial circuits, for the directive production of ether waves, are described and their action is explained by analogies and without mathematics as far as is possible. Chapter VI. describes, in groups, apparatus for the detection of impulses sent out from wireless telegraph circuits.

The book up to this point, some 215 pages, has segregated the matter on generating, radiating and detecting electrical or magnetic disturbances of the ether. In 60 odd pages following Chapter VI., the combinations of these apparatuses into practical radiotelegraphic systems are pictured. The quality of apparatus, the skill of operators and the completeness of organization needed, for successful commercial work, are made evident here. In this section of the book the author pays much attention to Marconi apparatus and stations. The sympathetic treatment of Mr. Marconi's achievements is possibly due in part to the author's association with him in the development of the transatlantic wireless service.

Methods of quantitative determinations of current, voltage, resistance, capacity, inductance, frequency, wave length, etc., are outlined. These methods are, of course, adapted for the high potentials and frequencies and for the long wave lengths prevalent in radiotelegraphy. The final chapter of the book, some 20 pages, takes up radiotelephony—varying the ether disturbances in accordance to the vibrations of articulate speech, receiving such waves on aerial circuits and transforming them to aural vibrations.

John Burns: Labor and Municipal Reformer and Statesman.

THE LIFE STORY OF THE RIGHT HON. JOHN BURNS, P. C., M. P.—By Arthur Page Grubb. London, England: Edwin Dalton. Cloth; 5 × 7¾ ins.; pp. 314; plates. 10s.; American price, $4.

The life of John Burns is of commanding interest to any wide-awake person. It has many special points of interest to engineers, and particularly to municipal and sanitary engineers. Besides many years of devoted and successful work as a citizen in connection with local affairs in the Borough of Battersea, which is a part of Greater London, Mr. Burns did yeoman service for nearly 20 years on the London County Council, and since 1905 he has been President of the Local Government Board. That board, through its control over loans for a large variety of municipal purposes and through its relation to both health and poor-law administration, has a great deal to do with a variety of engineering and other municipal problems. At the present time Mr. Burns has in hand proposed legislation aimed to effect notable reforms in town planning, and it may be presumed that he is giving careful attention to various reforms in handling sewage-disposal matters on the part of the Local Government Board which are involved in the recent recommendations of the Royal Commission on Sewage Disposal (see Eng. News, Oct. 8, 1908, p. 395).

Mr. Burns was born in Battersea in 1858, and, save for short periods, has lived there ever since. From ten to twelve years of age he worked in a candle factory. He then served a short period as a page, after which he became a "rivet-lad in Wilson's Engineering Works." At 14 years of age he had saved money enough to apprentice himself to "the engineering firm of Thorn's." In 1877, when he was 19 years of age, he secured an appointment as "foreman engineer" for the Niger Co., at Akassa, on the delta of the Niger, West Africa. Just what his duties were in this position the book does not make at all clear to the American reader. About a year appears to have been spent in Africa. On returning to England Mr. Burns appears to have continued his work in the engineering trades until his marriage in 1880. Subsequent to this event, he spent some months in Continental Europe studying labor conditions, utilizing the £100 which he had saved in Africa.

Throughout all the period thus far outlined, obviously, the subject of this biography had very little opportunity indeed for obtaining an education, except what he learned in the hard school of experience, and what he gained in self-instruction. He had improved his mind by considerable reading in economic and general literature, and had also gained mental strength and acumen, and attained no little prominence, as a public speaker in the interests of labor.

Inasmuch as the word "engineer" has a very different meaning in England from that given it in America, and since the author of this biography touches very lightly upon the early years of Mr. Burns' life, it is necessary to do some guessing as to what Mr. Burns really did as a workman in his pre-parliamentary years. The clearest picture of this to be found in the book is an extract from some remarks made by Mr. Burns on the occasion of opening the Brighton municipal electricity works in 1906:

> I was the first engineer to make with my own hands the first electric tram-car in this country. That was in 1881, and the croakers were just as bad then as they are now. Electric tram-way traction was then such a novelty that I had to take my governor's dynamo and tram down to the Crystal Palace and run the tram round the grounds for six months before people could be induced to believe that electric traction was possible. So nervous were people that, although the charge was only sixpence, we could not get them to go into the car at all. But bold men are not easily overcome by temporary difficulties like that, so I said to my wife: "You have got to come down to the Palace three times a week and get into the first electric tram-car as a decoy duck for the others." That was only temporarily successful, and so I had to bring along the mother-in-law; and when a husband, a wife and a mother-in-law cooperate, success is ensured.

As the years went on, Mr. Burns gained more and more recognition as a labor leader, by his addresses and his activities outside of working hours. Without ever taking office in Battersea, he was nevertheless instrumental in reforming the government of that district and making the local council overwhelmingly a wage-earners' council and the borough itself a shining example of carrying on municipal works by day labor instead of contract, and also of municipal ownership.

Having become, as he describes himself by a quotation from Shakespeare, "The Standard-Bearer of the Rude Mechanicals," and at the same time having gained an intimate knowledge of municipal affairs in Battersea and elsewhere in London, Mr. Burns naturally became one of the first members of the London County Council on its organization in 1889. Soon after, he was elected to Parliament as a member from Battersea. His services on both the County Council and in Parliament were made possible by a contribution of first £2 per week and later £3 per week for his support, by the Labor League of Battersea.

The splendid services which Mr. Burns rendered to London and to the nation as a member of both the bodies named, combined with his prominence in the great British labor movement in and out of Parliament, resulted in his being elevated to the cabinet as President of the Local Government Board when the Liberal party came into power in 1905. He has the distinction of having been the first so-called "working man" to take a seat in the cabinet, although some years earlier a representative of "labor" became a member of the ministry through an under-secretaryship.

We have not the space at our command to follow in more detail than has been given the life of this remarkable man. But we take pleasure in commending this biography as one which is full of interest from cover to cover.

We wish to call attention to two facts in connection with Mr. Burns' career: (1) The sobering and clarifying effect of a responsible official position upon the would-be reformer; and (2) the very sensible way in which Mr. Burns has gone on, inch by inch, gaining what ground he could for the human interests and the political principles which he so ardently espoused, instead of refusing, as some of his critics try to make out he should have done, to make a little headway now and then, because he could not achieve at a bound all that he desired and sincerely believed the people ought to have.

We cannot refrain, in closing, [quoting a] paragraph which, with some p[ersonal modifica]tions, pictures graphically an [experience which] the writer of this review had on [one of the most] pleasant and instructive half-da[ys of his life:]

> But on the doorstep I hustle again[st a bashful Amer]ican, armed with a letter of introdu[ction to me from] some one I don't know, and he wa[nts to "round up] London," from the sociological poin[t of view, in the] half-hour he has allotted to that ta[sk. Well, you do] your best to oblige him, just taking h[im in your stride] as you go about your morning's work[; by the time] the lunch hour has come, and you h[ave talked him a] vigorous eight miles, he guesses that [he will be quite] content to take the rest for granted[, and it would be] obliged if you would mail him all the [official reports of] those subjects that he has not had ti[me to personally] investigate.

Three Bulletins on Fuels.

BULLETINS, U. S. GEOLOGICAL SURVEY.—George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 5¼ × 9 ins.

No. 363: Comparative Tests of Run-of-Mine and Briquetted Coal on Locomotives. Including Torpedo-Boat Tests and Some Foreign Specifications for Briquetted Fuel. By W. F. M. Goss. Pp. 57; 4 plates and 35 text figures.

No. 366: Tests of Coal and Briquettes as Fuel for House-Heating Boilers. By D. T. Randall. Pp. 44; 3 plates and 2 text figures.

No. 365: The Fractionation of Crude Petroleum by Capillary Diffusion. By J. Elliott Gilpin and Marshall P Cram, under the supervision of David T. Day. Pp. 33; 3 text illustrations.

The first bulletin contains much general matter on comparisons of run-of-mine and briquetted coals, as well as tabulated and plotted data from a series of locomotive tests made in 1907 at the locomotive testing plant of the Pennsylvania R. R., Altoona, Pa. The arrangement of the plant itself is very briefly shown.

There is a description of the coal-briquet industry in Germany, where lignites are made into a highly desirable domestic fuel and where waste bituminous slack is utilized as a conservation measure. Foreign specifications for briquetted fuel are appended, as worked out for the Belgian, French and Prussian State Railways and for the Paris-Orleans Ry.

Locomotive service-run tests were made by seven railroads in various parts of the country in coöperation with the Geological survey and on one torpedo boat for practical comparisons of the same runs of coals, raw and briquetted. These tests are only very briefly spoken of in this bulletin.

From the data herein presented several things are to be inferred about the use of briquetted fuel for locomotive and similar service, where the combustion is rapid and the temperatures comparatively high: (1) The evaporation of water per pound of fuel is greater at all rates of evaporation than with raw coal and the boiler capacity is increased appreciably. (2) The quantities of cinders and sparks drawn from the firebox is not appreciably reduced by using briquets. (3) The smoke is less dense and the percentage of pitch binder seems to have very little effect on smoke or on evaporation. (4) With careful firing, briquets may be used to decrease locomotive smoke nuisance while running through city areas. (5) The briquetting of coal by the Geological Survey added about $1 per ton to the cost of fuel, and this is not compensated for by the increased efficiency of evaporation.

As briquetted coal had been tested, by the U. S. Geological Survey, under power boilers, with satisfactory results in economy and smokelessness, it was decided to find the value of similar coal for domestic heating boilers of the low-pressure, sectional type. At St. Louis, 58 tests were made—11 on raw coal and 47 with pitch-binder briquets. At Urbana 24 tests were made with the briquets.

A brief description is given in Bulletin 336 of house-heating boiler plants at the St. Louis structural-materials laboratory of the Geological Survey and at the University of Illinois engineering experiment station, Urbana, Ill.

Detailed results of the tests are shown in tabulated form. On comparing results of the tests there seems to be no advantage in briquets over lump coal of proper size for the grates. The pitch binders proved unsatisfactory at the low temperatures, and with the slow combustion of these small boilers. This caused undue smoking, gummed castings and decreased efficiency.

A phenomenon discovered by David T. Day forms the subject of the third bulletin. When crude petroleum was allowed to rise in a tube packed with fuller's earth there was a capillary fractionation of the oil into the different petroleum derivatives at different heights of the tube. A long line of experiments is disclosed and these seem of more interest to physical chemists and physicists than to fuel engineers. The results deduced may be summarized as follows:

(1) The fraction at the top of the tube of fuller's earth is of lower specific gravity than at the bottom. (2) When water is added to the fuller's earth holding petroleum, the oil first displaced is of different specific gravity than that of the oil displaced by further addition of water. (3) When oil held by fuller's earth is later displaced by water, about a third of the oil remains in the earth. (4) When petroleum is allowed to rise in a tube of fuller's earth the paraffin hydrocarbons tend to collect in the lightest fraction at the top of the tube, and the unsaturated hydrocarbons at the foot.

CEMENT PIPE AND TILE.—Advantages of Cement for Pipe and Tile. Methods of Manufacture, Tests, Cost, etc. By E. S. Hanson, Editor "The Cement Era." Chicago, Ill.: The Cement Era Publishing Co. Cloth: 5 × 7¾ ins.; pp. 110; text illustrations. $1.

If due allowance is made for the altogether partisan treatment of the clay-concrete controversy, this is a useful book for the man who wishes to enter the concrete-tile manufacturing business. It details the probable and actual uses of concrete tile, shows beyond the possibility of a doubt (in the author's mind) the superiority of the concrete pipe over the clay tile, outlines the various methods of fabrication, gives considerable cost data and finally describes several existing plants, from a study of which the prospective maker can learn much.

Steam Power Plants.

Reviewed by LIONEL S. MARKS.*

THE ECONOMY FACTOR IN STEAM-POWER PLANTS.—By George W. Hawkins. New York: Hill Publishing Co. Cloth: 6 × 9¼ ins.; pp. 133; 49 illustrations, partly in the text, and numerous tables. $3, net.

HEAT ENERGY AND FUELS.—Pyrometry, Combustion, Analysis of Fuels and Manufacture of Charcoal, Coke and Fuel Gases. By Hans v. Jüptner, Professor, Imperial and Royal Technical Institute, Vienna. Translated by Oskar Nagel, Ph. D. New York: McGraw Publishing Co. Cloth; 6 × 9¼ ins.; pp. 306; 118 illustrations in the text and 136 tables. $3.

ANLEITUNG ZUR DURCHFUEHRUNG VON VERSUCHEN AN DAMPFMASCHINEN UND DAMPFKESSELN.—Zugleich Hilfsbuch für den Unterricht in Maschinenlaboratorien technischer Lehranstalten. By Franz Seufert, Principal of the Royal College of Mechanical Engineering at Stettin. Second edition, enlarged. Berlin, Germany: Julius Springer. Cloth; 5¼ × 8½ ins.; pp. 81: 40 illustrations in the text. 2 marks; American price, 80 cts.

The title of Mr. Hawkins' book is somewhat misleading, as the only problem dealt with is the determination of the fuel consumption of a steam plant per unit of power delivered. In his preface the author says "So far as is known there is not another single volume comprehensively treating this subject." If he will examine R. H. Smith's "Commercial Economy in Steam and Other Thermal Power-Plants," he will find a very much more comprehensive, but at the same time a very different, treatment of the subject.

Mr. Hawkins' book is written for oil-burning electric-power plants and the formulas deduced express the performance of the plant in KW.-hours per barrel of California crude oil; by the use of various conversion charts these results are readily changed into other fuel units. The author is obviously strongly influenced in his views and figures by the remarkable performance of the Redondo plant, which was communicated to the American Society of Mechanical Engineers in December, 1908.

The plan of the book is simple. First of all, the performance of the elements of a steam plant are considered; then a number of formulas are built up for the fuel consumption under full load test conditions for steam plants of various types; and finally, factors are determined for taking into account variable load and standing losses.

The accuracy of the results depends entirely upon the efficiencies assumed for the various elements of the plant. The values given can scarcely be accepted without question in all cases. The efficiency of a water-tube boiler using oil fuel is given as over 80% for a range of loads from 76% to 160% of the rated load; the efficiency being a maximum of 83% at 15% overload. In his paper on the firing of fuel oil (presented to the American Society of Mechanical Engineers in December last) Weymouth gave certain calculations of ideal efficiencies of boilers using California crude oil. With only 10% excess of air, with 3% assumed radiation loss, and with a chimney temperature of 400° F., the ideal efficiency is 84.2%. It is true that an efficiency of 83.3% has been recorded with California crude oil, but it does not seem probable that anything like that can be maintained in the normal operation of a plant. It should be noted that the steam used for atomizing the oil (usually from 2 to 3% of the steam formed) is not taken into account in these assumed efficiencies or in the test just referred to.

Steam engines are divided into four classes: automatic high-speed engines, four-valve engines, gridiron-valve engines and turbines. The steam consumption to be expected from the best examples of these types, condensing and non-condensing, simple and compound, at various loads, and with units of various sizes, is given by a number of economy curves. The author certainly does full justice to the extraordinarily good results obtained from the large McIntosh & Seymour engines; he assumes 10.5 lbs. of steam per I. HP. per hour from 48 to 100% of the rated load, and a mechanical efficiency at full load of 96%, for the 5,000-KW. units. To the steam turbine, however, he does not do justice; for 5,000-KW. units he shows a steam consumption increasing from 16.7 lbs. per KW.-hour at full load to 19.6 lbs. at half load., and that with the same superheat as in the McIntosh & Seymour engines. A considerable decrease in efficiency with decrease of load is not a necessary characteristic of the steam turbine. An 8,000-KW. turbine of a well-known type with superheat and vacuum slightly better than the conditions assumed for the 5,000-KW. unit, gives a KW.-hour on 14 lbs. of steam at full load, and on 14.4 lbs. of steam at 60% of full load.

The amount of work done, and the probable steam consumption per I. HP. per hour, in the various auxiliaries, air pumps, circulating pumps, feed pumps and oil pumps are treated of briefly. There is not much use in calculating the power of the feed pump as exactly as is done, when it is not known whether the steam consumption of the pump is to be 80 or 240 lbs. per I. HP. per hour. It would have simplified calculations and would probably have been just as accurate if the steam consumption of the feed pump had been assumed to be a definite fraction of the total feed water.

The information given as to boilers, engines and auxiliaries is made use of in the construction of various formulas for finding the fuel consumption of projected plants at full load. The plants are divided into (1) non-condensing, (2) surface-condensing, and (3) jet-condensing plants. Formulas are worked out for a non-condensing plant, a surface-condensing plant with steam driven auxiliaries, a surface-condensing plant with power-driven auxiliaries, a jet-condensing plant and for three types of pumping plant. The equations deduced are simple equations involving the steam consumptions and efficiencies of the various parts of the plant, the factor of evaporation and the calorific value of the fuel. The engineer is saved the solution of these simple equations by numerous full-page and double-page graphs and by numerous tables. Examples of the use of the formulas are given. Finally, the method of modifying the formulas for variable load and for stand-by losses is given briefly and is illustrated by an elaborate example.

The book represents a great deal of labor in compilation and in the drawing of sets of curves. But it is doubtful if it has accomplished anything of value to the engineer. When the anticipated performance of each member of a plant is known it is a simple matter to find the fuel consumption of the whole plant, and it is surely more satisfactory to an engineer to work it out for himself than to take a formula containing certain constants which naturally he cannot accept without examination. The formulas have only an academic interest, and the tables and curves, since they save only a few multiplications, divisions and additions, have as their practical value only the light which they throw on the influence of various factors on the fuel consumption.

The author himself is not always correct as to the influence of the various factors. He states that the fuel consumption of a plant varies inversely as the factor of evaporation, and this opinion is based on the observation that the factor of evaporation occurs in the denominator of each of his formulas for fuel consumption. But he is obviously incorrect. The same factor of evaporation may occur in a plant with (1) cold feed water and no superheat, or with (2) hot feed water and a high superheat. The greater efficiency of the engine in this latter case will decrease the total fuel consumption. Among other errors it may be noted that the efficiency of a perfect engine using superheated steam is given as $\frac{t_1 - t_2}{t_1}$

t_1 and t_2 being the absolute temperatures of the steam at admission and exhaust respectively.

It is to be regretted that the author did not make his work more comprehensive by giving the data for determining the commercial efficiency of steam plants. There is a distinct need for more information on the subjects of the first cost, depreciation, cost of repairs, supplies, the attendance and the numerous other factors that go to determine the total cost of the unit of power. Something of this kind was done about 16 years ago by Dr. Emery, who worked out the actual cost of power under a large variety of assumed conditions; his figures were very useful at the time, but now they are naturally of historic interest only.

Professor v. Jüptner has written a compendious four-volume work on chemical engineering. He divides the subject into two parts; in one the object of the process is to transform chemical energy into other forms of energy; in the other, to transform raw materials by chemical processes into substances of a different chemical composition. The first volume deals with energy transformations, and is itself divided into three parts; Part I. takes up the subject of heat measurement, combustion and fuels; Part II. contains the science of firing, with a discussion of the different methods of industrial firing; Part III. treats of the chemical methods of refrigeration. The work which is before us is a translation of Part I. of Volume I.

Many of the comprehensive and exhaustive treatises covering a whole field of technology which have appeared from German pens are monuments rather to the patience and industry of the author than to any more inspired quality. In the present case, however, we have a work by a man whose name is associated with much important research in his field, and who is in other ways eminently well qualified to undertake the work.

After a chapter of general remarks introductory to the whole subject of chemical engineering, and another chapter dealing with the forms of energy and the laws of energy transformation, the author takes up the subject of heat measurement. Three chapters are devoted to the measurement of high temperatures, with descriptions of the instruments, their theory, errors, methods of use, reliability, and so forth. Mercury thermometers, graphite and metal pyrometers, Wedgewood's clay pyrometers, gas thermometers, thalpotasimeters, Princep's alloys, Seger cones, calorimetric pyrometers, optical pyrometers, electric resistance and thermo-electric pyrometers and the thermophone are all considered in much detail. The principal results of investigations of these instruments are stated and some thirty tables of physical constants relating to them are given.

The experimental determination of the heat of combustion of fuels is taken up rather less comprehensively, the Fischer constant pressure calorimeter, the Mahler constant volume calorimeter and the Parr calorimeter alone being de-

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scribed. The method given for finding the lower heat value of coal from a Mahler bomb determination (by absorbing the moisture of the products of combustion in a calcium chloride apparatus and correcting for its latent heat) has been shown by Hempel to be incorrect on account of the presence of the sulphuric acid which results from combustion of the sulphur in coal and which retains some of the moisture. A clear discussion is given of the relation between combustion heats at constant volume and at constant pressure, and also of the relation between combustion heat and combustion temperature. This latter is commonly neglected by engineers, but is of importance in gas engine practice; for example, the heat of combustion of Carbon monoxide at 1,000° C. is about 2% lower than its heat of combustion at 15° C.

The chapter on the indirect methods of determining the heat of combustion of fuels has an account of the attempts (of which several are very recent) to establish some relation between various characteristics of the fuel and its heat of combustion. The calculation from the elementary analysis is well known (Dulong's formula), as is also the method based on the determination of the oxygen required for combustion (Berthier's method). Gmelin's method is based on the ability of the coal to retain hygroscopic water, and with the constants which he gives, yields better results than Berthier's process. The author's method is much more rational and accurate; it depends on the proximate analysis and on the oxygen required for combustion of the volatile matter. The formulas of Arth, Goutal, Mendeléeff and de Paepe are also given.

Many recent investigations have thrown considerable light on the subject of chemical equilibrium and on the influence of pressure, temperature and concentration on the dissociation accompanying chemical reactions. The effect of these factors in determining the completeness of combustion and the temperatures resulting from the combustion of gaseous and solid fuels is gone into very completely and clearly.

The remainder of the book takes up the study of fuels, classifies them in many ways, gives numerous tables of their chemical composition, heat values and physical characteristics, works out the chemical relationship between the various natural fuels and describes the apparatus and methods of making the principal artificial fuels. Separate chapters are devoted to wood, peat, lignite, bituminous and anthracite coal, charcoal, coke and coking apparatus. Liquid fuels are disposed of summarily. Producer gas, water gas, Dawson gas and producer gas plants have each a separate chapter. The theoretical composition of producer gas and water gas are worked out under various assumed conditions of pressure and temperature with the aid of the valuable investigations of Boudouard, and important deductions are made as to the desirable working conditions in a producer.

The most valuable part of this book to the practicing engineer is 137 tables of physical constants and chemical composition which are incorporated in the text, and which give a large mass of information in a well arranged and well digested form. For the student the theoretical parts, the application of the new methods of physical chemistry to the technical problems of combustion should prove of great interest.

The work of the translator and of the proof-reader have been done so poorly as to render certain parts of the book almost unintelligible. For example, we find the following "reason" for the use of excess air in combustions: "The reason for this is the difficult and incomplete mixture of the gases to be burned with the combustion air and the occurrence of incomplete reactions." Another example: "Pyrometric thermal efficiency is called the temperature that can theoretically be reached by combustion of the fuel." The chemical equations are full of errors.

Prof. Seufert's small book is a concise, clearly written laboratory manual, of an elementary character, for steam-engine and boiler testing. The instruments, arrangement of apparatus, methods of procedure and of calculation for making commercial tests of steam machinery are explained very simply, with illustrative examples taken from practice. If someone would take this book as a basis and would write an engineering laboratory manual covering a much wider range, but following the same general method, it might fill a much-felt lack in engineering text-books in the English language.

MECHANICS OF ENGINEERING.—Comprising Statics and Kinetics of Solids, the Mechanics of the Materials of Construction, or Strength and Elasticity of Beams, Columns, Shafts, Arches, etc., and the Principles of Hydraulics and Pneumatics, with Applications. For Use in Technical Schools. By Irving P. Church, Professor of Applied Mechanics and Hydraulics, College of Civil Engineering, Cornell University. Revised Edition, partly rewritten. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5⅝ × 9¼ ins.; pp. 854 + xxvi.; 657 illustrations, mostly in the text. $6; English price, 25c. 6d., net.

Since its first publication in the late eighties, Prof. Church's exhaustive treatise has been the backbone of the study of engineering for a generation of students in various colleges of the country, more especially at the university where Mr. Church himself has supervised with marked ability the instruction in this most important of the theoretical portion of an engineer's training. No additional praise that can be given here will add to the already assured reputation of the book. The treatment is so thorough that at first it seems unnecessarily long and complicated, but once the general scheme is mastered, a fair knowledge of the calculus, being assumed, the uniformity of method and the continuity of the development convey a certain simplicity which is a surprise to the student, who, at first, is bewildered by the apparently indigestible mass of the book. It is primarily a text-book for students, with the rare characteristic, an adaptability to the practicing engineer. Those engineers who used the book in their college days generally keep it as a rather ponderous vade mecum to which the more abstract problems of their professional work may be referred.

This last edition is to a large extent rewritten and rearranged. Practical problems have been added at the end of each section, matter of occasional interest relegated to an appendix and the older formulas, references and designs brought up to date. Additional matter has been added in the shape of a chapter on reinforced-concrete beam design and in the theory of circular ribs and hoops and thick hollow cylinders and spheres.

A German Manual of Material-Testing.

HANDBUCH DES MATERIALPRUEFUNGSWESENS FUER MASCHINEN- UND BAUINGENIEURE.—By Otto Wawrsiniok, Adjunct at the Royal Technical College, Dresden. Berlin, Germany: Julius Springer. Cloth; 6 × 9¼ ins.; pp. 573; 501 illustrations, mostly in the text. 20 marks; American price, $8.

This is essentially a condensed treatise on German testing methods. The author takes the scientific viewpoint. That is to say, he deals with laboratory testing rather than shop or field testing. This is no defect, of course, since it tends toward thoroughness and precision, but it leads him to omit mention of the numerous rough-and-ready or less precise methods that characterize shop testing.

Besides describing methods, the book gives a long chapter to testing-machines, in which some twenty-five machines are described and illustrated by drawing and photograph. These are all German machines, however; not a single British or American machine is mentioned, not even the unique Emery machine at Watertown.

In fact, the entire book is confined to German practice, and while this may be approved as far as the general plan of the book is concerned, it tends to produce frequent misconceptions, especially in the chapters on methods of testing. Thus, under the head of form of tension test-piece (of round steel or iron), the reader is told only of the turned test-piece with enlarged heads for the grips and taper portions adjoining the straight middle portion; but he ought also have been informed that straight round rods held in wedge grips give excellent results in America, the fracture rarely occurring in the grips. Again, under the head of cement briquets, he should be told that American cement testing does not approve of tamping the mortar in the mold, and that most results reported from America refer to untamped briquets.

Besides methods and machines, two or three other subjects are included in the book. There is a chapter on measuring instruments—excluding load-weighing appliances and gages, which are included with testing-machines. Vernier and micrometer scales, extensometers, balances, instruments for specific gravity determinations, thermometers and pyrometers and the like are described in this chapter, each of which seems to belong more properly to a physics laboratory manual. Another chapter is taken up with tests of completed articles and structures—as load tests of sewer pipe, floor slabs, stairs, etc., and fire tests. This may be considered quite foreign to the general plan of the book, inasmuch as these tests are exclusively "practical" and, with rare exceptions, are special to the individual case. On the other hand, it is gratifying to find a chapter on Elements of Metallography and a short appended section on the non-microscopic structure of wrought-iron and steel; both these sections may prove serviceable to the practical tester no less than to the student.

The two main parts of the work deal respectively with tests of metals (160 pp.) and tests of materials other than metals (150 pp.). These chapters present an excellent, well-arranged account of the various processes of mechanical testing, and the attendant phenomena. The treatment, besides being not as exhaustive as that of a treatise, is conservative, in that such matters as notched-bar tests and tests under reversed stress receive but scant notice. The restriction to German practice must also be remembered. There are some minor weaknesses, moreover; for instance, a statement that there are three "elastic limits," namely, the yield-point, the limit of proportionality and the limit of elasticity, is expressed in confusing manner, while at another point is found a statement that in an electric resistance heater "it is clear that a different temperature must prevail at the beginning of the helix than at its end." But these defects are relatively imperceptible, and on the whole the two chapters in question give a valuable presentation of the subject. The value of the book depends mainly on these chapters. For the American reader, therefore, the work affords a good survey of the methods employed in scientific material-testing in Germany.

ARTIFICIAL WATERWAYS AND COMMERCIAL DEVELOPMENT.—(With a History of the Erie Canal). By A. Barton Hepburn, LL.D., D.C.L., Author of "The Contest for Sound Money," etc. New York: The MacMillan Co. Cloth; 5 × 7¾ ins.; pp. 115. $1, net.

The reader who expects to find in this book a broad, general review of the whole subject of waterways, with apreciation of their economic relations to modern transportation systems will certainly be disappointed. The author of the book, a New York banker, has apparently obtained his knowledge regarding waterways from the campaign literature widely circulated in connection with the movement to secure state appropriations for the building of the $101,000,000 barge canal across New York nine years ago. Of the 92 pages which the book contains, 62 are devoted to one chapter on the Canal system of New York, and the remainder is taken up with 8 pages on the Panama Canal and 15 pages in which the Canals of the world are summarized. An appendix of a dozen pages contains statistical tables of some value, relating chiefly to the operation of the New York canals.

The author lays great stress upon the idea that the artificial waterways of the country have been abandoned because they were under public ownership and were not maintained and operated as they would have been by a private enterprise, in the same manner as the railways. He makes no mention of the fact that a considerable part of the canals which have been abandoned were actually owned and operated by private companies. There is need of a really first rate book in the field which this one pretends to cover, but it should be written by someone with a broader viewpoint and greater technical knowledge than the author of this work.

How to Solve Some of the Problems of Municipal Government.

PROBLEMS OF CITY GOVERNMENT.—By L. S. Rowe, Ph.D., LL.D., Professor of Political Science, University of Pennsylvania. New York: D. Appleton & Co. Cloth; 5 × 8 ins.; pp. 358. $1.50, net.

The theme of a large part of Prof. Rowe's book is that the form or mechanism of city government ought to be adapted to the function of the city as an organization. This makes the volume timely in these days of charter making and mending.

After dealing with the history of cities from ancient to modern times, Prof. Rowe considers "The Nature of the Municipal Problem." The briefest expression of this problem that we find in the chapter devoted specifically to it is a sentence setting forth present shortcomings, as follows:

> The lack of definite civic standards and ideals, the absence of an intense city life, the failure to develop a distinctive form of municipal government and to establish definite relations between the municipality and the state constitute the main counts in the indictment against our existing system.

We need "new civic standards, based upon distinctly city ideals." We need, also, to get away from the idea that city government should be modeled after state and national governments, with their checks and balances; and we should recognize that "city problems are primarily of an administrative rather than a political character, and that "neither the mayor nor councils can encroach upon the civil and political rights of the citizen." The city problem being so largely administrative in character, a large measure of reliance must be placed on department heads, and these should be chosen for ability and retained in office as long as they perform efficient service.

The social and also the political consequences of city growth are next elaborated upon, after which the author states his conception of "The Position of the City in the American Political System." The central idea of this chapter is that the city should be given what it now so generally lacks, a well-defined place of its own, free from state interference except as regards essentially state as distinct from local policies. In other words, an adequate measure of "home rule" is demanded. This, in turn, requires effective central administrative control. Such control substitutes the expert supervision possible under a board selected for the purpose for the necessarily know-nothing control or interference of a heterogeneous assemblage of state assemblymen and senators. In the course of this chapter the Western practice of allowing cities to frame their own charters is reviewed.

Chapters on the legal powers and on the organization of cities follow. The first of these needs no comment save general approval. In the second the author ably sets forth the American "faith in mechanism," as exemplified by its many and continuous changes in the form of city government. In contrast:

> It is a remarkable fact that while the form of municipal government in continental Europe has remained almost unchanged during the last century, the cities of the United States have been passing through at least three distinct stages, in each of which an essentially different form of municipal organization has prevailed. Europe has been endeavoring to perfect the operation of a given system, while in the United States we have been searching for a form of government so perfect in its adjustment as to assure efficiency without the necessity of the constant vigilance and active cooperation of the population.

The author divides municipal development in the United States into three periods: (1) Council supreme, in some cases even electing the mayor, as is still the case in Great Britain; (2) distribution of powers between council and mayor; (3) "the mayor acquires a dominant position, while the elective council is gradually stripped of its more important functions." In so far as the latter stage has not yet been reached we are rapidly marching towards it to-day. The departure from the last-named movement, and a most notable one, is the "commission plan," in which a council of only five members, including the mayor, is at once a legislature, appropriating and executive board, with each of the five members, or else all but the mayor, a department head. Here the old system of "checks and balances" disappears completely, and also all separation of legislative and executive functions. With the commission system, responsibility is concentrated in the highest degree short of one-man authority, and public opinion can make itself felt as under no other plan. But public opinion, to be effective, must be intelligently guided (the Bureau of Municipal Research, New York City, is an example of a possible guiding method). Public opinion must be exercised with restraint. It must be brought to bear upon State legislatures as well as on municipal officials, especially as our author does not believe it wise, in the movement for home rule, for the legislature to strip itself quite so fully of the power of municipal control as some reformers urge. In leaving this chapter we quote its final sentence, which bears upon the last points made:

> The standards of public opinion must be so well defined and the standard of capacity of the legislatures so high as to assure the continuous recognition of those principles of government upon which the successful working of democratic institutions rests, namely, confidence of the people in their representatives, combined with a degree of self-control in the state legislatures, which will enable the municipalities to determine their local policy without fear of interference from without.

In the course of his valuable chapter on "City Government and American Democratic Ideas," the author again points out the necessity of getting away from the notion that municipal government should be framed with the protection of individual rights as its chief concern. Instead, it should be directed to meet the wants of modern city life through organized collective action. To get things done and done well cities will have to pattern more and more after the executive management of commercial and industrial corporations. The author says:

> The desire for greater administrative efficiency may lead us to a type of government in which the determination of executive policy will be left exclusively to the mayor and his heads of departments. * * * The accumulated experience of American cities has shown that unless the council is reduced to a single chamber, with a small membership, responsibility cannot be enforced.

If the council be retained it must not only be small (11 or 9 members), but, to prevent continual interference with the mayor and other executive heads, its activities must be rigidly restricted to legislative functions. Councilmanic control of appointments to executive offices destroys responsibility and impairs the efficiency of the whole executive (or doing-things) department of the city—and the city of to-day, if it fulfils its functions, exists primarily to do things. This chapter concludes as follows:

> It is important for those who are interested in the betterment of city government to realize that while in the organization of government compromises may be attempted, the actual operation of any system is determined by deep underlying forces over which the individual has little control. The compromises that have been dictated by our unwillingness to accept the consequences of certain fundamental canons of political organization have placed our city governments at the mercy of a small group of men who understand these principles more clearly than we, and who are able to manipulate this organization for their own ends.
>
> The traditional fear of absolutism need not deter us from making the mayor the real executive head of the city government. Correctly interpreted, this plan offers possibilities of popular control which our present system lacks. At all events, it is well for us to understand that the demand for efficiency, which the American people place above their desire for democratic rule, will inevitably lead to this concentration of executive power. The real alternative is, therefore, whether this concentration of power will be accompanied by the destruction of the city council, or whether the city council will survive as an organ of government restricted to purely legislative functions.

The remaining third or more of the book must be dealt with more briefly. It has to do wholly with the control of public-service corporations and with municipal ownership. Besides discussing fundamental principles, the author uses as concrete illustrations Philadelphia's experience with municipal and private ownership of gas-works and German experience with city ownership of street railways. Both these chapters abound with instructive and interesting facts and figures and equally commanding deductions therefrom. The final chapter of the book is on "Municipal Ownership and Operation: The Value of Foreign Experience.

Many weak and sore spots in municipal government are exposed to view in these chapters, and likewise many faults of private ownership of public utilities. Foreign experience, the author urges, should be considered judicially, with both the pros and cons before one. After which deductions should be applied with a full understanding of differences in foreign and American conditions.

The author appears to incline strongly towards municipal ownership, with limitations set in each case by local conditions. He believes that only by extending municipal activities can the needs of the city dweller be met, and that in meeting these needs a civic spirit and ideal will be created that will react favorably upon both the citizens and their public servants. This will lead to a wider, deeper and more intelligent popular interest in municipal affairs and greater efficiency on the part of municipal officials.

EX-MERIDIAN ALTITUDE, AZIMUTH AND STAR-FINDING TABLES.—With Diagrams for Finding the Latitude and Facilitating Plotting Lines of Position and Giving New and Practical Methods for Identifying Stars in Cloudy Weather. Latitudes 0°-65°; Declinations 0°-71° North and South. By Lieutenant-Commander Armistead Rust, U. S. Navy. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 6 × 9½ ins.; pp. ii. + 393; six folding plates. $5.

These navigation tables and diagrams center about a table of first approximation for reducing the star altitudes to meridian altitude. In this, each integral degree of latitude has six pages, in which the values of the reduction are given for declinations in whole degrees, north and south, and for hour-angles varying by 4 mins. up to 60 mins. The tabular value is the "first reduction." For each declination there is also given the value of change of altitude per minute of hour-angle, and its logarithm, which serve variously in checking hour-angles, etc. This main table occupies 393 pp. The auxiliary tables are: (1) a two-page table of 5-place logarithms; (2) corrections to altitude observations (horizon, refraction, semi-diameter, etc.); (3) corrections for height of eye (less or more than 20 ft.); (4) altitude corrections per minute of time; (5) errors due to errors in latitude; (6) arc and time equivalents; and (7) hour-angles and altitudes at prime vertical transits, for latitudes and declinations varying by whole degrees. There are six plates, containing the "second reduction," etc. The introductory text is very brief, too brief, perhaps, for the desired degree of clearness.

NAUTICAL CHARTS.—By G. R. Putnam, M. Am. Soc. C. E., Director of Coast Surveys, Philippine Islands, 1900 to 1906. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5⅝ × 9¼ ins.; pp. 162; folding and other plates. $3.

The intricacies of mapping the high seas and coastal waters are described simply but instructively in Mr. G. R. Putnam's "Nautical Charts." The age of the subject, and its slow development to the high level attained to-day, are sketched in an opening chapter on the history of sailing directions and charts of the sea. The author then describes the survey methods, the processes involved in making the drawings and plates from which the printed charts are produced, the governmental conduct of the work, etc., etc. The book was prepared in connection with a lecture on charts delivered at Columbia University, and therefore bears the characteristics of a semi-popular work. But it is clear and instructive as far as it goes, and the fact that it leaves the wish that the author had taken time to go more into detail may be due to his success in engaging the reader's interest.

That the book deserved to be written is further grounded in the fact that there exists no general writing on nautical charts, although the subject of maps and mapping of land areas is treated in numerous books and is generally understood. Yet charts are perhaps more numerous than land maps, for the various governmental and private chart publishers issue over a million copies of charts per year (according to the author), comprising about 10,000 different sheets.

COMMISSIONER OF HIGHWAYS (Maine).—Annual Report for the Year 1908. (Paul D. Sargent, Commissioner.) Augusta, Me.: Pub. Doc. Cloth; 5½ × 9¼ ins.; pp. 212; plates and tables.

Besides reviewing the work of the year, some cost data are given. The proceedings of the First New England Road Conference, held in Boston Nov. 23-24, 1908, are given 26 pages.

A New Book on Steam Turbines.

Reviewed by A. G. CHRISTIE.*

THE STEAM TURBINE.—A Practical and Theoretical Treatise for Engineers and Designers, Including a Discussion of the Gas Turbine. By James Ambrose Moyer, M. Am. Soc. M. E., M. Am. Inst. E. E., Engineer, Westinghouse, Church, Kerr & Co., Author of "Descriptive Geometry for Students of Engineering," etc. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¾ × 9¼ ins.; pp. 370; 225 illustrations in the text and 1 folding diagram in pocket. $4.

The art of steam-turbine construction has advanced so rapidly during the last few years that the majority of engineers have been unable to keep fully in touch with the theoretical and commercial questions involved. Much of the earlier literature on the subject dealt largely with the theoretical questions and made little attempt to modify the theoretical results to fit practice. The attempt to do this in the above book is a step in the right direction.

It is rather hard to place this book of Mr. Moyer's. While excellent in many ways, it would scarcely do for use by students in engineering nor yet is it a handbook for the average operating engineer. It includes in general the class of information regarding steam turbines which is in circulation, especially among commercial engineers, modified to some extent by methods and formulas introduced by the author.

Its unfitness as a book for students' use is mainly because of the substitution of empirical formulas in many cases where it is important that the students should study the theoretical equations representing fundamental principles and to understand how these are modified to suit conditions found in practice.

There is no doubt that a careful study of steam-turbine data would show that many relations could be expressed adequately for engineering purposes by empirical formulas, and the author has endeavored to do this in the present book. However, in most cases, he does not lay before the reader the experimental data on which he bases his results. Were these presented it would materially increase the value of the book.

Another very noticeable feature of the book is the great number of foot-notes which, in many cases, could have been included in the text without over-burdening it.

In the first chapter, the author gives a brief historical review of the earlier steam turbines. The second chapter treats the elementary theory of heat as applied to steam turbines in a very simple and comprehensive manner. Entropy-temperature diagrams are employed to advantage to illustrate the action of the steam. The application of these diagrams to superheated steam might well have been placed in this chapter instead of in the following one.

In Chapter 3. nozzle design is discussed, and a number of empirical formulas introduced which greatly simplify the solution of problems. On page 45 the author should make it more clear that the formula given for length of nozzles applies only to types where the pressure difference on the two sides of the nozzle is relatively small. The treatment of the subject in general is clear.

Chapter 4 is devoted to the discussion of steam-turbine types and blade design. In discussing the impulse turbines, the author's references to "velocity stages" and "pressure stages" are apt to be confusing to a reader not thoroughly acquainted with the various types of turbines. The diagram on page 79 is misleading, as impulse blades are shown to illustrate velocities in reaction blading. The author's design of a Parsons turbine follows the old method which he, himself, styles "rule of thumb." Much better results have been obtained in practice by designing with the use of the heat diagram, assuming non-adiabatic expansion. A thorough investigation of the nature and location of the losses in a Parsons turbine will probably lead to greater improvements in general results than those the author suggests, which have mainly to do with the mechanical construction and do not throw light on the conditions affecting economy.

In Chapter 5, dealing with the mechanical losses in steam turbines, the formulas on friction losses would be improved by the inclusion of the experimental test data from which they are derived.

Chapter 6 shows the methods for correcting steam-turbine results to reduce them to standard conditions. Chapter 7 takes up commercial types; Chapter 8 with the methods of governing steam turbines; Chapter 9 with low-pressure steam turbines, and Chapter 10 with marine turbines. One cannot help noticing, in reading these chapters, that while Curtis and Westinghouse-Parsons turbines are described very fully, the author seems to have had no experience with other types and has described them after the fashion of trade catalogs and magazine articles.

Chapter 11 briefly describes test methods. Steam-turbine economics are dealt with in Chapter 12. In this chapter the author's statements regarding the relation of altitude and vacuum are misleading. Between the same limits of absolute pressure, the economy of the steam turbine is independent of the altitude, and hence relatively high vacuum is as desirable at high altitudes as at sea level. The work required of the condenser auxiliaries, however, become less as the altitude is increased. The author has evidently got his types of turbines interchanged on page 282 in discussing the best economic results with superheat. It is generally understood that Curtis turbines give higher superheats than do the Parsons.

In Chapter 13, discussing the stresses in rings, drums and disks, the author does not make himself clear, on page 319, where "N" may mean the increase in thickness of the shaft due to the weight of the blades, or the thickness of shaft itself, inwhich case it is far too small to be of any practical value.

The gas turbine and its possibilities are discussed in Chapter 14, and electric generators for steam turbines are briefly dealt with in Chapter 15.

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A Dictionary of Railway Signalling.

RAILROAD SIGNAL DICTIONARY.—An Illustrated Vocabulary of Terms which Designate American Railroad Signals. Their Parts, Attachments and Details of Construction, with Descriptions of Operations and Some Illustrations of British Signals and Practice. Compiled for The Railway Signal Association by Braman B. Adams and Rodney Hitt, Associate Editors of the "Railroad Gazette." New York: "Railroad Age Gazette." London, England: "The Railway Gazette." Leather; 8½ × 12 ins.; pp. of text, 32; 3,120 illustrations. $6.00.

In 32 pages of dictionary text and 472 pages of illustrations, interspersed with a small amount of text matter, Messrs. Adams and Hitt have embodied a very ambitious attempt to set forth the arrangements and mechanisms of American railway signaling and interlocking in full detail. How their attempt has succeeded is to be judged by the completeness and correctness of the information they present, and by its acessibility, that is to say the ease of finding a desired piece of information.

As to completeness, the authors have not only attained their mark, but overshot it considerably. Much space is wasted in what is really duplication. To cite a single instance: page 192 is occupied by drawings of no less than 14 "box wheels" (chain guide-wheel sets for mechanical signal connections) which are all exactly alike except for the number of wheels in the set, the smallest having 4 wheels, the largest 20 wheels. This page, with three other pages of illustrations of chain and wire guide wheels, could have been adequately covered in one-eighth as much space, half a page. There is a large amount of similar waste throughout the book. Partly on this account the illustration part of the book virtually forms a consolidated catalog of signal manufacturing companies, rather than an illustrated cyclopedia or album of the art.

As to accessibility, the authors have probably done the best that was possible with the unwieldy mass of material. The dictionary text, of course, was easily handled; it is alphabetically arranged, and wherever possible the definition is helped out by a reference to the appropriate illustrations in the album section. The album, however, is a different problem. The authors group the illustrations in five parts: Signal Indications, Block Signals, Highway Crossing Signals, Interlocking, Block and Interlocking Accessories. While these groups overlap to some extent, yet they permit a reasonable separation of matter. Within each group, however, the arrangement is largely arbitrary. As the largest group (Interlocking) covers 187 pages, with 1,407 illustrations, it would be very difficult to find a particular detail or arrangement if some further aid were provided. This is found in a classified index and an alphabetical index, given at the beginning of the album. By their means the complete collection of 2,850 illustrations becomes reasonably accessible.

The work is more effective in its presentation of details than in its statements of methods and principles. The details of interlocking devices and accessories, for instance, are very fully set forth, but the explanation of the actual working of interlocking in the machines can hardly be called successful. The Dictionary is of little use to the learner in signaling, therefore its function is to serve as a reference manual of the multifarious commercial mechanisms and devices that make up the present-day art.

In contemplating the great labor and cost represented by this book, one regrets that European practice in railway signaling is omitted entirely, especially as it could well have been put in without increasing the bulk, by saving the space wasted in purposeless repetitions, as above referred to. There is regret, also, that the authors were so conservative that they devoted only one page to the subject of automatic stop (showing only one device), while such devices as cab signals are not shown at all.

Altogether the authors have accomplished a very difficult and ungrateful task in highly commendable manner. The real value and effectiveness of their work, we may presume, must be judged by the market which the book will find. If it should reach a second edition, as is to be hoped, there will be opportunity for simplification and shortening, and for covering also European practice.

MODERN METHODS OF SEWAGE DISPOSAL.—A Practical Handbook for the Use of Members of Local Authorities and Their Officials. By W. H. Trentham, M. Inst. M. E., M. Inst. E. E., and James Saunders, Assoc. M. Inst. C. E. London, England: The Sanitary Publishing Co., Ltd. Cloth; 4¾ × 7½ ins.; pp. 60; 14 plates. 2s. 6d. net. American price, $1.

Although this little book is designed primarily for laymen, it will well repay many engineers not conversant with the larger books on sewage treatment to spend the half-hour or so necessary to run through its pages. The principles of sewage treatment are briefly and plainly set forth, as also the leading facts regarding modern systems of treatment. A section of value and interest to the American reader would be the eight pages devoted to the "Powers and Duties Imposed on Local Authorities by the Legislature." The authors appear to be particularly impressed by the Dibdin slate bed as a means for the preliminary treatment of sewage. They go so far as to say that for this purpose nothing "can compare" with the slate bed, and that "the total elimination of the sludge difficulty" is thus effected. Illustrations of actual sewage works, drawn from the practice of the authors, are presented.

GUIDE TO SANITARY INSPECTIONS.—By William Paul Gerhard, M. Am. Soc. M. E. Fourth edition, entirely revised and enlarged. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 4¾ × 7½ ins.; pp. 229. $1.50. English price, 6s. 6d., net.

Included with the new matter given in this edition is a chapter on the sanitary inspection of public buildings, and another on sanitary surveys of cities and towns. Many question schedules or blank forms for use in recording the results of inspections are presented. Since the book is now in its fourth edition, nothing further need be said regarding it, except that a great deal of time and space might have been saved by laying down first of all the features of sanitary inspection common to all buildings, and then citing variations for city and country houses, schools, hospitals, etc. There is, of course, some advantage in having each section complete, but we do not think that it begins to compensate for the disadvantages and for the necessary additional cost of the book.

Applied Mechanics.

Reviewed by ALFRED H. KNIGHT.*

APPLIED MECHANICS FOR ENGINEERS.—A Text Book for Engineering Students. By E. L. Hancock, Assistant Professor of Applied Mechanics, Purdue University. New York: The Macmillan Co. Cloth; 4¾ × 7¾ ins.; pp. 385; 205 illustrations in the text. $2, net.

In many engineering schools in this country the need has been felt for a wider application of the principles developed in the mathematics courses so that the student might be better able to make use of them in a practical way. Practicing engineers as well as students have gone so far as to say that much of the time spent upon pure mathematics was wasted, except for the mental discipline obtained. Necessarily the mathematician and the engineer regard the subject from different points of view. To the engineer the application is the all important part; to the mathematician it is merely an incident.

Evidently, with a realization of this condition, Prof. Hancock has endeavored to prepare a text which would give abundant application to every principle developed, and in this application to use problems such as an engineer would be likely to encounter. In this endeavor he has been reasonably successful, though, unfortunately, the general treatment of the subject and the methods of attacking problems do not seem to be quite in accordance with the methods of the engineer. It is hardly fair, however, to condemn the book upon this ground, since the same criticism applies with equal force to the older works upon this subject.

Presupposing a knowledge of algebra, trigonometry and calculus, the solution and composition of forces is first taken up, following which is a chapter on centers of gravity, treating the subject at somewhat greater length than is usual in texts of this character. Methods for finding the centers of gravity of plane areas and solids are fully discussed. In addition to the use of calculus, Simpson's rule, which should be better known to engineers, is explained and its use illustrated.

Couples and non-current forces are discussed in the two following chapters. The vector method of representing couples is used, and the general problem of non-concurrent forces in space is treated at some length.

A long chapter is devoted to moments of inertia. Methods for finding moments of inertia of areas and solids for both parallel and inclined axes are explained. In this chapter the author makes an exception to his usual rule and introduces a graphical method. It is to be regretted, however, that the most important feature of this construction has been omitted.

In the chapter on flexible cords a very good treatment of the catenary is given and a number of other common problems are discussed briefly.

Rectilinear, curvilinear and rotary motions are given an extensive and very satisfactory treatment. The chapter on dynamics of machinery, among other things, discusses the important subject of gyroscopic action which is lacking in many of the older books. Balancing of revolving masses is also considered, though the treatment is not entirely satisfactory.

The difficult subject of friction is discussed at considerable length and formulas for various types of bearings are developed upon the tacit assumption of a uniform distribution of pressure. Belt friction, band brakes and several types of dynamometers are explained and the usual formulas derived.

The book concludes with a chapter on impact, which treats the subject very completely.

In general, the subjects discussed are presented in a clear manner and there is an abundance of figures illustrating the text. Some few misleading statements are noticeable, as when the author states in deriving an expression for the tractive effort of a locomotive:

> We may disregard the work of friction of the cylinder and cross-head since the sum is zero. That is, the work done by the piston on the cylinder, due to friction, equals the work done by the cylinder on the piston due to friction.

There are also a number of minor errors both in the text and in the figures, but perhaps not more than might be expected in a first edition.

The book abounds in problems designed to furnish application for every principle developed. Many of these show originality and they are in general of a practical nature.

No pretence is made of treating of the strength and resistance of materials and no mention is made of stress except in the discussion of impact, where the author gives a brief explanation of the modulus of elasticity. Bending moments are carefully avoided and graphical methods are noticeably absent.

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Three German Books.

NEUE VERSUCHE AN EISENBETON-BALKEN UEBER DIE LAGE UND DAS WANDERN DER NULLINIE UND DIE VERBIEGUNG DER QUERSCHNITTE; VERSUCHE UEBER REINE HAFTFESTIGKEIT.—By Richard Müller. Berlin, Germany: Wilhelm Ernst & Sohn. Cloth; 7¼ × 10½ ins.; pp. 87; 37 plates and 39 text illustrations. 7½ marks; American price, $3.

ENTWURF EINES WASSERKRAFTWERKES IM GEBIET DER MURG OBERHALB FORBACH.—By Th. Rehbock, Professor in the Grand-ducal Technical College "Fridericiana" at Karlsruhe. Leipzig, Germany: Wilhelm Engelmann. Stiff paper; 8¼ × 13 ins.; pp. 47; 22 plates and 2 text illustrations. 8 marks; American price. $3.20.

DIE PORTLAND-ZEMENT-FABRIKATION.—Ein Handbuch für Ingenieure und Zementfabrikanten. By Carl Naske. Second edition, revised and enlarged. Leipzig, Germany: Theod. Thomas. Paper; 7 × 10¾ ins.; pp. 410; 2 plates and 359 text illustrations. 17 marks; American price, $6.80.

The wide range of variation in physical character by which reinforced concrete is distinguished, in conjunction with the numerous unsolved or doubtful questions concerning its behavior, gives opportunity to find something new in every experimental study. So also in the doctor-thesis experiments published under the title "New Tests of Reinforced-Concrete Beams." The chief object of study here was the position of the neutral axis and the distortion of initially plane cross-sections. Several interesting methods of measurement were employed; one of them was to photograph the side of a beam twice on the same plate, before and after deflection, measuring on the photograph the mutual displacement of cross lines drawn on the beam, which not only permitted accurate measurement, but also furnished a permament record subject to remeasurement at any time. The results obtained by the author are perhaps not very weighty, the series of tests being very small, but there are several stimulating suggestions in the results as well as in the methods.

The proposed 80,000-HP. hydraulic power development at the boundary of Baden and Wurttemberg, which will be the largest in Europe, is interesting because it contemplates the complete exploitation of the fall section of a river. It includes the development of several tributary streams by high dams feeding through tunnel pipe lines to the main power plant, and what is more interesting still, the excess power from the small-capacity intake on the main stream is to be stored by pumping water up to the storage reservoirs on the tibutaries. The net head obtained from the main stream is about 480 ft., that from the tributaries about 1,140 ft. Impulse wheels furnish the power, and high-head turbine pumps driven by induction motors operate the water-saving pumping plant. The cost of the power obtainable (mean annual output) is figured at from ¼ to ⅝ ct. per KW.-hr.

The second edition of "Portland Cement Manufacture" finds the German industry approximating much nearer to the American type than was the case six years ago, when the first edition appeared. The rotary kiln has come into wide use in the interval. Correspondingly the author is able to take his examples largely from German practice, though America is by no means wholly neglected. The book, it should be remarked, describes the machinery and manipulations of cement making rather than its chemistry. There is a useful appendix on cement tests and on the standards of different countries.

On Certain Mechanical Appliances.

THE MECHANICAL APPLIANCES OF THE CHEMICAL AND METALLURGICAL INDUSTRIES.—A Complete Description of the Machines and Apparatus Used in Chemical and Metallurgical Processes for Chemists, Metallurgists, Engineers, Manufacturers, Superintendents and Students. By Oskar Nagel, Ph.D., Consulting Chemical Engineer. New York: The Author (P. O. Box 385). Cloth; 6 × 9¼ ins.; pp. 311; 292 illustrations in the text. $2, net; English price, 8s. 6d., net.

The author approaches his subject from the standpoint of the buyer or user rather than that of the builder or the designer. It considers the principles of operation of the appliances treated and their suitability for different purposes, and does not enter into an intimate discussion of their design or construction. Its value is mainly descriptive.

The first half of the volume is devoted to appliances not inherently peculiar to the chemical and metallurgical industries. This portion deals with steam, water, gas and electric prime movers, and with systems of conveying solids, liquids and gases. The second half takes up grinding, mixing and separating machines, furnaces, gas purification, evaporating, distilling, condensing and drying appliances and temperature measurement. An abstract from a paper on "The Works Chemist as Engineer," read by Oscar Guttmann before the Society of Chemical Industry, is introduced as an appendix.

The first chapter, for some obscure reason, is entitled "General," and is made up of descriptions of the various forms and uses of pipe-covering, packing, valves and other fittings. The title of the second chapter, "Steam and Water Power," may likewise be misleading. The bulk of this chapter consists of information concerning boilers, feed water and the steam calorimeter, taken from a book published by a prominent boiler manufacturer; four or five pages give general descriptions (which are really little more than lists of the various parts) of a steam engine, and of the Parsons steam turbine. Water-power is briefly disposed of in a few paragraphs containing remarks about the Pelton wheel. The chapter on "Electric Power" is an exposition of the advantages of electrical power transmission for industrial plants.

In several instances the author has gone too far in the expression of sweeping and general opinions as though they were well acknowledged or authenticated facts. In Chapter V., for example, referring to the Renold silent chain, appears the statement that "the most extensive use of this chain in America has been on drives of motor vehicles, and Chapter IV. in its opening sentence informs the reader that "as a means of power supply for practically every purpose, the electric motor drive stands pre-eminent." The last quotation appears to have been evolved in the agony of getting started on the subject of "Electric Power," and, together with many others of a like nature, might better have been omitted.

The book as a whole is well arranged and well written, and the explanations are reasonably clear and concise. It will be of value to anyone wishing to get an idea of the arrangement and operation of any of the numerous appliances described.

STATE ENGINEER OF CALIFORNIA.—Report, May 11, 1907, to Nov. 30, 1908. (Nathaniel Ellery, State Engineer.) Sacramento, Cal.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 213; plates and text illustrations.

A variety of classes of engineering work which had previously been carried on independently have recently been brought together under the charge of a California Department of Engineering. The operations of this department since consolidation are here reported on. They relate to roads, rivers—including in the latter debris-restraining works; also water-supply and other investigations carried on in conjunction with the U. S. Geological Survey, and a variety of public buildings. The Engineering Department comprises an advisory board composed of the Governor of the State, the President of the State Board of Harbor Commissioners, the General Superintendent of State Hospitals, and the State Engineer. Working with this body is a river consulting board. The office force includes the State Engineer and State Architect, and various assistants.

Steinmetz on Electrical Engineering.

GENERAL LECTURES ON ELECTRICAL ENGINEERING.—By Charles Proteus Steinmetz, Ph. D., Past President Am. Inst. E. E., Consulting Engineer of the General Electric Co., Professor of Electrical Engineering in Union University, Author of "Alternating Current Phenomena," etc. Edited by Joseph LeRoy Hayden. Schenectady, N. Y.: Robson & Adee. Cloth; 6 x 9¼ ins.; pp. 284; 48 illustrations in the text. $2.

These lectures are broad pen pictures of the developments of theory and practice in electrical engineering, by one generally recognized as peculiarly fitted to undertake such a task. The work is essentially, though not entirely, non-mathematical. The more mathematical parts will be puzzling, to say the least, to the ordinary student or reader, though their import will be recognized by those engineers or teachers who, being familiar with that work, do not need to profit thereby. The trouble seems to lie in insufficient explanation of the symbols used and in confusion in the use of lower-case and capital letters as symbols.

The book is divided into 19 parts, 17 of which are lectures given at Union University. The remaining two sections, though called appendices, are papers read elsewhere.

The first lecture gives a broad survey of the industrial application of electric power, under the main divisions of (1) traction, (2) electrochemistry, and (3) lighting and stationary mechanical power. The succeeding lectures expand this treatment. The second and third take up the distribution of current, with particular reference to the comparative economy of ordinary and multi-wire systems. In the fourth lecture the factors making up the cost of power supply are analyzed.

The next four lectures are on high tension phenomena: Long distance transmission; resonance with abnormal voltage and current; high-frequency harmonics in waves of voltage and their influence in producing abnormal voltages in power and lighting circuits; high-frequency oscillations, induced by sudden changes in circuit conditions; the interchange of electro-static and magnetic distribution of energy. In Lecture 6, where the author takes up the inherent higher-frequency harmonics of voltage curves of generators and transformers, he writes of "constant-potential and constant-current harmonics." It can only be expected that these terms will be more or less meaningless without better defination to persons not familiar with the design of alternating current machinery and circuits.

Lectures 8 to 10 give a brief comparison of prime movers and discuss the operation of various generators and motors. Lecture 11, with Appendix 2, will be found an illuminating and interesting history of the development of lightning-protection apparatus. The twelfth, thirteenth and fourteenth lectures are on electric railroading, paying particular attention to the effect of direct and alternating-current motor characteristics on train service. Lecture 15 is on commercial electrolytic and electro-thermal processes.

Lectures 16 and 17 describe the important electric lighting systems and should be read with Appendix 1, which is a clear exposition of the aims and methods of "illuminating engineering."

WATER AND SEWAGE PURIFICATION PLANTS IN OHIO.—Report of an Investigation Made under Authority of an Act of Legislature, passed Feb. 23, 1906. (Dr. C. O. Probst, Secretary State Board of Health.) Columbus, Ohio: Pub. Doc. Cloth; 6½ x 9¾ ins.; pp. 888; folding and other plates, text illustrations and tables.

Under specfic legislative authority the Ohio State Board of Health has made a detailed investigation of water and sewage-purification plants, both public, institutional and private, within the borders of the state. The report before us includes descriptions of all these plants, taking up their history, engineering features, and methods and results of operation. Included in "Results" are copies of analytical and cost figures. These figures are quite extensive in some cases and relatively meager in others, but altogether constitute a valuable feature of the report. In addition to the detailed descriptions there are summary statements regarding both water and sewage purification. An abstract of these statements was given in Engineering News, of April 9, 1908. The whole work was carried out under the direction of Dr. C. O. Probst, Secretary of the Board. Mr. R. Winthrop Pratt, Chief Engineer of the Board, had general supervision of the engineering work, and contributes to this report the general reviews mentioned. The examination of water-purification plants was made and the report on that subject written by Mr. Philip Burgess, Special Assistant Engineer. In like manner, Mr. A. Elliott Kimberly handled sewage-purification plants, including supplementary reports on the disinfection of sewage effluents and on the purification of acid iron wastes at Shelby. Mr. Kimberly also contributes to the volume a special report on the water softening plant at Oberlin. Even were not the report printed in a somewhat small (though readable) type, its nearly 900 pages of text and illustrations would go far ahead of anything that has yet been done at any one time by any other State in the way of reporting on its water and sewage-purification plants. The commendable descriptions of sewage-purification works in the State of New York, published in the last report of the New York State Department of Health (see p. 20, Engineering Literature Supplement, Feb. 18, 1909), filled only 100 pages or so, for which relatively large type was used.

The Chances for More Portland Cement Plants.

THE PORTLAND CEMENT INDUSTRY FROM A FINANCIAL STANDPOINT.—By Edwin C. Eckel. New York: Moody's Magazine. Cloth; 6 x 9¼ ins.; pp. 93; one folding map and four diagrams in text. $2, net.

In the United States there are at present, or were a few months ago, when the figures were compiled, 113 Portland cement plants with a total annual capacity of about 85,000,000 bbls. In the year 1907 these plants produced less than 49,000,000 bbls. of cement. Furthermore, the statistics for 1908, not yet fully compiled, seem to show that the production for the latest year has decreased—a decided novelty in the heretofore rapidly-growing cement industry. In view of these facts the need for new cement plants is hardly apparent and certainly the financial success of such plants, in competition with well-established mills, is extremely doubtful. However, the cement plant promoter is probably still abroad in the land and the average banker and broker is doubtless still importuned to subscribe for stocks and bonds of well-advertised cement properties, in which time is claimed to be the only element necessary to create wealth.

It is for the benefit of such bankers and other investors that Mr. Eckel has written this book. Preceded by just enough technical information to inform the non-technical man of the nature of cement and of its processes of manufacture, the main discussion treats of the financing of cement mills, largely by sarcastic references to obviously get-rich-quick enterprises which have been foisted on the public of late. After this exposé of the flimsy financial foundation of most of the claims made by new companies, the author enters into a discussion of the rightful financial basis for a cement mill and shows, by the example of some successful companies, just what profits may reasonably be expected from a well-managed concern.

There is no attempt made to explain the costs of building or running a mill or to detail the technical side of such construction or maintenance. The book is purely and simply for prospective future investors, and as such it will probably be much appreciated. The only criticism that may be made, and that can only be from the standpoint of the promoter who is trying to establish his financial basis, is that the author seems to be holding a brief for the established interests; his whole attitude is one of discouragement of new plants, a very obvious desire on the part of those who are already in the business. As we noted at the beginning of this review, the construction of new plants seems hardly financially advisable, still the map published as a frontispiece to Mr. Eckel's book shows large blank spaces in the western part of this country where a cement plant might find a market which could be held even against the competition of older but more distant mills.

BRENNAN'S HANDBOOK.—A Compen[dium] of Useful Legal Information for Business M[en]. By B. A. Brennan, Contract Manager of the W[estinghouse Ma]chine Co., Pittsburg, Pa. New Yo[rk: John Wiley] & Sons. London, England: Chapm[an & Hall, Ltd.] Leather; 4 x 7 ins.; pp. 571. $5, net [English price,] 21s., net.

The author in the preface to his b[ook says:]

The compilation of this handbook was [occa]sioned primarily by my effort to arrange a compact [and] systematic compendium of useful legal information [for ready reference in connection with my duties as Co[ntract Manager] of the Westinghouse Machine Co.

This avowed intention and the po[sition] of the author explain quite clearly the scope [of] the book. It is an abstract of business law [for] business men, particularly for those business m[en] who are connected with the selling end of larg[e] manufacturing and engineering firms. It t[ouches] but lightly on the general principles of co[ntracts,] devotes somewhat more attention to th[e] details of sales contracts and then passes to an extended description of various legal instrum[ents] which are common in business, such as deeds, mortgages, liens. Chapters on financial paper, acknowledgments, power of attorney, guarantees, etc., are followed by synopses of the various statutory requirements on conditional sales, chattel mortgages, mechanic's liens, bills and notes and collection laws. Finally there are a number of legal forms which should prove useful. A very complete index adds considerably to the value of the book.

LAW AND BUSINESS OF ENGINEERING AND CONTRACTING.—With Numerous Forms and Blanks for Practical Use. By Charles Evan Fowler, M. Am. Soc. C. E. New York: McGraw Publishing Co. Cloth; 5¾ x 9 ins.; pp. 162; text illustrations. $2.50, net.

The larger portion of the matter in this book is a development of a course of lectures by the author to the engineering students of the University of Washington. As a result of the rather personal nature of such lectures, the treatment of the subject in the book is more colloquial than is usually found in treatises on contracts and specifications. These lectures, however, have been supplemented with examples of model contracts and specifications so as to make a more specific treatment than is possible in a classroom. In addition there are chapters upon methods of estimating and bidding on work and upon the organization of contracting companies.

The book is not an extended treatise on specifications or contract law, but rather an instruction book to young engineers regarding the difficulties that beset contract work and the methods to avoid them.

THE INTERPRETATION OF TOPOGRAPHIC MAPS.—By Rollin D. Salisbury and Wallace W. Atwood. Professional Paper 60, U. S. Geological Survey; George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 9 x 11½ ins.; pp. 84; 170 plates and 34 text figures.

By means of over 170 specimen maps and photographs the authors of this rather bulky government document have illustrated the educational value of the well-known topographical maps that are being issued by the U. S. Geological Survey. Each map is accompanied by text which explains some special feature that this particular map best illustrates, and thus the many advantages to be derived from a study of these excellent surveys may be appreciated. Although intended more specifically for teachers of geography, geology and topography, a study of the book will repay any one who is interested in the natural features of his country.

STATE ENGINEER AND SURVEYOR OF THE STATE OF NEW YORK.—Annual Report for the Fiscal Year Ending Sept. 30, 1907. (Frederick Skene, State Engineer and Surveyor.) Albany, N. Y.: Pub. Doc. Cloth; 5½ x 9 ins.; pp. 636; numerous plates and tables, and two folding maps in pocket.

Aside from matters of routine administration, this report is chiefly interesting for its illustrated description of progress, up to the summer of 1907, on the great New York State Barge Canal.

MESSAGE OF HON. GEORGE B. McCLELLAN, THE MAYOR, TO THE BOARD OF ALDERME[N] (New York).—New York: Pub. Doc. Stiff paper; 9 x 10¾ ins.; pp. 134; numerous folding and other plates.

The final message of Mayor McClellan's four-year term presents by the aid of handsome typography, illustrations and presswork a somewhat comprehensive review of what has been attempted and achieved during his term of service. A large number of half-tones are included.

Johnson's Railway Transportation Revised.

AMERICAN RAILWAY TRANSPORTATION.—By Emory R. Johnson, Ph. D., Professor of Transportation and Commerce in the University of Pennsylvania, Author of "American and Inland Water Transportation." Second edition, revised. New York: D Appleton & Co. Cloth; 5 × 7½ ins.; pp. 434; folding and other plates, and text illustrations. $1.50.

We are very glad to see that the demand for Professor Johnson's excellent work has made necessary the publication of a third edition. In view of the great activity in railway legislation during the past few years, and the heated discussion of the subject of railway regulation in legislatures, newspapers and courts, it is of great value to have such an authoritative and unprejudiced work as this of Professor Johnson.

We think that even those who have closely followed the proceedings of Congress and of state legislatures during recent years will be surprised to see what progress has been made in establishing state and federal control. And this control seems likely to be exercised in the future through commissions rather than by direct legislative acts.

A current example of this which comes to our notice at this time is the defeat in Indiana of a law requiring all locomotives to be fitted with headlights of a certain candle power. The probabilities seem good that the law was promoted by some concern interested in securing the introduction of electric headlights. It was defeated on the sound ground that all such regulation should originate with the State Railway Commission, and not with the legislature.

We are rather surprised to see in the chapter on State Railway Commissions that no mention is made of the New York Public Service Commission Law, and the enlarged powers of control which were granted under it. This law is serving as a model for legislation in numerous other states, and seems likely to be an important step forward in state regulation of monopolies.

In the above brief review, we have referred to the concluding portion of the work, devoted to the relation between the railways and the state; but it should be understood that the scope of the book is much broader. The opening chapters are devoted to a description of the American railway system, with much interesting historical matter. Then follows an account of the railway service, including that of freight, passengers, express and mail; with the general organization and the system of records in use. Then comes a complete section devoted to the relations between the railways and the public. It may be added that the price of the book is exceedingly low for a work containing such a large amount of valuable matter, and one which is of such usefulness as a work of reference.

REPORT ON THE INDETERMINATE FRANCHISE FOR PUBLIC UTILITIES.—Submitted Dec. 29, 1908, by Milo R. Maltbie, Commissioner. New York: Public Service Commission for the First District (154 Nassau St.). Paper; 5¼ × 9 ins.; pp. 34.

A long-time and thorough student of franchises and other municipal affairs before becoming a member of the Public Service Commission, Mr. Maltbie has since had special opportunity and occasion to continue his studies and practical observations. He here states the principles which should be observed in framing franchises, then outlines the nature of and objections to both perpetual and short-term franchises. The indeterminate franchise—"tenure during good behavior"—is then considered at length, both in theory and practice—the latter including a review of actual experience in Massachusetts, the District of Columbia, Wisconsin, and New York City itself.

A pamphlet of 144 pages, accompanied by a large album of 22 plates, all relating to the construction of the new Mytishzinsk Aqueduct at Moscow, has been received from Mr. Nicholas P. Simin, Chief Engineer of the Moscow Water-Works. The text matter is in Russian. It reviews work carried on from 1897 to 1906, and describes two pumping plants and the construction of some conduits. Detailed cost figures are given, and also contract specifications for pumping machinery and cast-iron pipe.

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The first volume of this series of novel dictionaries, "Machine Details and Tools," appeared in 1906, and now three of the ten additional volumes promised are at hand. (See this supplement, June 14, 1906, for notice of the first volume.) The work is in six languages throughout; English, German, French, Russian, Italian and Spanish. The arrangement is not alphabetical in any one language, but is arranged in topical groups and sub-groups, which are best located by the table of contents. At the end of each volume is an alphabetical index in each of the six languages. The center of each page is left for pictures of the apparatus or ideas defined. On the right of this cut, or blank space when no cut is possible, are the Russian, Italian and Spanish terms and on the left are the German, English and French. There are some eight to twelve topics on each page.

Volume II. subdivides the field of electrical engineering into the following subjects, given in their respective order: batteries, boilers and engines, machinery, switching apparatus, instruments, stations, circuits, house installation, lighting, lightning, telegraphy, telephony, electrochemistry, electro-therapeutics and units.

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The volume on "Internal-Combustion Engines" (No. III.) is the smallest of the three new ones and is divided into sections on gases and oils, theory of internal-combustion engines, materials and construction of engines, engine erection, complete plants, testing and economics.

It seems necessary in using these dictionaries to best advantage first to acquire a general familiarity with the scheme of arrangement. After this is done they should be of no little service to engineers working in these languages.

INDUSTRIAL-SOCIAL EDUCATION.—By William A. Baldwin, Principal of the State Normal School, Hyannis, Mass. Assisted by Mrs. Baldwin and Members of the Faculty. Springfield, Mass.: Milton Bradley Co. Cloth; 6¾ x 9½ ins.; pp. 147; plates and text illustrations. $1.50.

There is here set forth in an interesting way an account of one of the many attempts now being made in various parts of the country to bring primary and secondary education more into line with the nature of the live boy and girl, and with his or her probable life work. The introductory chapters of this book discuss educational problems in some of their broader phases and from the point of view just indicated. The conclusion is that the natural desire of every normal child to do things should be recognized in school instruction, and that the things done should be useful. Accordingly, the Hyannis Normal School for a few years past has been teaching children to make various useful articles and to do useful garden work. The things made or raised are sold and the children share in the income gained, thus, as anybody can see, greatly stimulating their interest in their work.

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SMOLEY'S TABLES.—Parallel Tables of Logarithms and Squares, Angles and Logarithmic Functions Corresponding to Given Bevels, Together with a Complete Set of Five-Decimal Logarithmic-Trigonometric Tables. For Engineers, Architects and Students. By Constantine Smoley. Fifth edition, revised. New York: The Engineering News Publishing Co. London, England: Archibald Constable & Co., Ltd. Flexible morocco; 4¾ × 7 ins.; pp. 448. $3.50, net.

This new edition of the well-known tables of squares and logarithms of foot-and-inch dimensions has been enlarged by adding (1) a multiplication table of rivet-spacing up to 30 spaces, for eighths of an inch from 1 in. to 6 ins.; (2) five-place logarithm tables of numbers and of trigonometric fractions, and (3) a table of the natural values of trigonometric fractions. The book becomes more bulky through the increase in contents, but not enough to become unhandy.

Publications Received.

AERIAL WARFARE.—By R. P. Hearne. With an Introduction by Sir Hiram Maxim. London, England: John Lane. New York: John Lane Co. Cloth; 5¾ × 9 ins.; pp. xxxix. + 237; 57 plates. $2.50, net.

AIDS TO SHIPPERS.—New York: Oelrichs & Co. (Forwarding Department). Boards; 6¾ × 9 ins.; pp. 62. Sent free on request.

ALTERNATING-CURRENT MACHINES.—Being the Second Volume of Dynamo Electric Machinery, Its Construction, Design and Operation. By Samuel Sheldon, Ph. D., D. Sc., Past-President Am. Inst. E. E., Professor of Physics and Electrical Engineering at the Polytechnic Institute of Brooklyn, and Hobart Mason, Assoc. Am. Inst. E. E., and Erich Hausmann, Assoc. Am. Inst. E. E., Instructor in Electrical Engineering at the Polytechnic Institute of Brooklyn. Seventh edition, completely rewritten. New York: D. Van Nostrand Co. London, England: Crosby Lockwood & Son. Cloth; 5 × 7¾ ins.; pp. 353; 236 illustrations in the text. $2.50, net.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.—(Successor to the Association of Railway Superintendents of Bridges and Buildings.) Proceedings of the 18th Annual Convention, Held in Washington, D. C., Oct. 20-22, 1908. S. F. Patterson, Concord, N. H., Secy. Paper; 6 × 9 ins.; pp. 326; folding plates and text illustrations.

AMERICAN SOCIETY FOR TESTING MATERIALS.—Proceedings of the Annual Meeting Held at Atlantic City, N. J., June 23-27, 1908. Vol. VIII. Edited by the Secretary, under the Direction of the Committee on Publications. Philadelphia, Pa.: The Society (Edgar Marburg, University of Pennsylvania, Secy.). Paper 6 × 9 ins.; pp. 706; folding plates and numerous text illustrations.

THE ARMOUR ENGINEER.—The Semi-Annual Technical Publication of the Student Body of Armour Institute of Technology. Vol. I., No. 1, January, 1909. Paper; 6½ × 10 ins.; pp. 114; illustrated. 50 cts. per copy; $1 per year.

BOARD OF EXAMINERS OF ARCHITECTS (Illinois).—Sixth Biennial Report. The Law, Rules of the Board, and List of Licensed Architects. Chicago, Ill.: The Board (Peter B. Wight, Secy., 1112 Chamber of Commerce). Paper; 5¾ × 8½ ins.; pp. 60.

BOARD OF HARBOR AND LAND COMMISSIONERS (Massachusetts).—Annual Report for the Year 1908. (George E. Smith, Chairman.) Boston, Mass.: Pub. Doc. (No. 11). Paper; 5¾ × 9 ins.; pp. 68; folding and other plates.

BOARD OF RAILROAD COMMISSIONERS (Iowa).—Annual Report for the Year Ending June 30, 1907. (N. S. Ketchum, Chairman.) Cloth; 5¾ × 9 ins.; pp. 574; illustrated.

BOARD OF RAILROAD COMMISSIONERS (Massachusetts).—Annual Report, January, 1909. (Walter Perley Hall, Chairman, Fitchburg, Mass.) Boston, Mass.: Pub. Doc. (No. 14). Cloth; 5½ × 9 ins.; pp. xxxvi. + 391; two large folding maps.

BOARD OF STATE HARBOR COMMISSIONERS (California).—Biennial Report for the Fiscal Years Commencing July 1, 1906, and Ending June 30, 1908. W. V. Stafford, President Commissioners. Sacramento, Cal.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 91; folding plates.

BRITISH COLUMBIA.—Bulletins, Bureau of Provincial Information (R. M. Palmer, Secy.). Victoria, B. C.: Pub. Doc. Paper; 5¾ × 8¾ ins.

No. 10: Land and Agriculture in British Columbia. (8th edition.) Pp. 98; illustrated.

No. 22: New British Columbia. The Undeveloped Areas of the Great Central and Northern Interior. (9th edition.) Pp. 104; two large folding maps.

BULLETINS, U. S. GEOLOGICAL SURVEY.—George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.

No. 354: The Chief Commercial Granites of Massachusetts, New Hampshire and Rhode Island. By T. Nelson Dale. Pp. 228; 9 plates and 27 text figures.

No. 363: Comparative Tests of Run-of-Mine and Briquetted Coal on Locomotives. Including Torpedo-Boat Tests and Some Foreign Specifications for Briquetted Fuel. By W. F. M. Goss. Pp. 57; 4 plates and 35 text figures.

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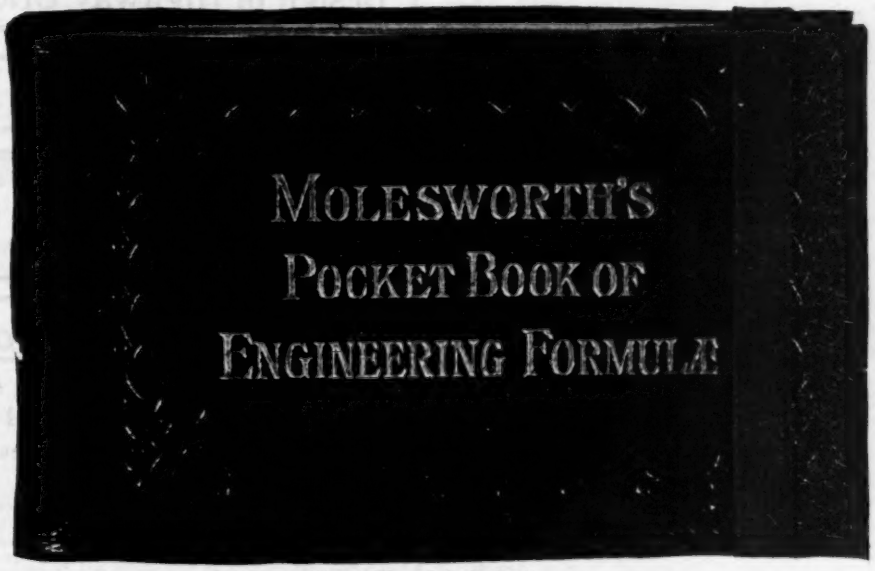

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No. 368: Washing and Coking Tests of Coal at the Fuel-Testing Plant, Denver, Colo., July 1, 1907, to June 30, 1908. By A. W. Belden, G. R. Delamater and J. W. Groves. Pp. 54; two plates and three text figures.

BUREAU OF MINES (Ontario).—Annual Report, 1908. (Vol. XVII.) (Thomas W. Gibson, Deputy Minister of Mines.) Toronto, Ontario: Pub. Doc. Paper; 6½ × 9½ ins.; pp 356; folding plates and text illustrations.

BUREAU FOR THE SAFE TRANSPORTATION OF EXPLOSIVES AND OTHER DANGEROUS ARTICLES.—Report of the Chief Inspector, February, 1909. New York: Bureau of Explosives (24 Park Place). Paper; 7¼ × 10¼ ins.; pp. 71. $1.

CAR FENDER AND WHEELGUARD TESTS.—Report Submitted to the Public Service Commission for the First District, New York State, Dec. 29, 1908. (Reprinted from Proceedings of Dec. 29, 1908.) New York: The Commission (Travis H. Whitney, Secy., 154 Nassau St.). Paper; 6 × 9¼ ins.; pp. 17; folding and other plates. [See Eng. News, Feb. 25, 1909, for extracts from this report.—Ed.]

CHAUDIERES MARINES ET ACCESSOIRES.—Avec Notes de Résistance des Matériaux et de Thermodynamique. By L. Jauch and A. Masméjean, Professors in the Ecole des Mécaniciens at Toulon. Part I. Toulon, France: J. Aîté. Paper; 6½ × 9¾ ins.; pp. 521; 1 folding plate and 300 text illustrations; 37 plates in separate volume, 7¾ × 10¾ ins. 22 francs; American price, $6.00.

CHEMICAL AND BIOLOGICAL SURVEY OF THE WATERS OF ILLINOIS.—Report from Sept. 1, 1906, to Dec. 31, 1907. Edward Bartow, Director. University of Illinois Bulletin, Water Survey Series No. 6. Urbana, Ill.: The University. Paper; 6 × 9 ins.; pp. 88; illustrated.

COAST AND GEODETIC SURVEY.—Report of the Superintendent, Showing the Progress of the Work from July 1, 1907, to June 30, 1908. (O. H. Tittmann, Supt.) Washington, D. C.: Pub. Doc. Cloth; 8¾ × 11½ ins.; pp. 169; nine folding sheets in pocket.

COST OF PUMPING FROM WELLS FOR THE IRRIGATION OF RICE IN LOUISIANA AND ARKANSAS.—By W. B. Gregory, Professor of Experimental Engineering, Tulane University of Louisiana. Bulletin 201, Office of Experiment Stations; A. C. True, Director. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 39; two illustrations in the text.

DENVER MUNICIPAL FACTS.—Issued Every Week by the City of Denver. Vol. I., No. 2, Feb. 27, 1909. Denver, Colo.: Compiler, Municipal Facts. Paper; 9 × 12¼ ins.; pp. 16; illustrated. Free on request.

DEPARTMENT OF PUBLIC WORKS (Saskatchewan).—Annual Report for the Financial Year 1907-8, Ending Feb. 29, 1908. (Walter Scott, Commissioner of Public Works.) Regina, Sask.: Pub. Doc. Paper; 6¾ × 10 ins.; pp. 248; plates and text illustrations.

DIRECTOR OF FORESTRY (Philippine Islands).—Annual Report for the Period July 1, 1907, to June 30, 1908. Major George P. Ahern, Director of Forestry. Manila, P. I.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 26.

DIRECTORY OF PORTLAND CEMENT MANUFACTURERS.—Together with Manufacturers of Gypsum and Lime. Corrected to Jan. 1, 1909. Chicago, Ill.: "The Cement Era." Flexible leather; 3 × 5 ins.; pp. 220. $1.

EXPORTERS' ENCYCLOPEDIA.—Fifth (1909) Edition. Containing Full and Authentic Information Relative to Shipments for Every Country in the World. New York: Exporters' Encyclopedia Co. Cloth; 5½ × 8¼ ins.; pp. 656. $5.

A FEW PERTINENT FACTS CONCERNING THE PHILIPPINE FORESTS AND NEEDS OF THE FOREST SERVICE, THAT SHOULD INTEREST EVERY FILIPINO.—Major George P. Ahern, Director of Forestry. Circular No. 3, Bureau of Forestry. Manila, P. I.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 21.

LA FORME DU LIT DES RIVIERES A FOND MOBILE.—By L. Fargue. (Part of "Encyclopédie des Travaux Publics," begun by M.-C. Lechalas.) Paris, France: Gauthier-Villars. Paper; 6½ × 10 ins.; pp. 187; 50 illustrations, partly in the text. 9 francs; American price, $2.70.

THE GAS ENGINE.—By Forrest R. Jones. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¾ × 9¼ ins.; pp. 447; 142 text illustrations and 30 tables. $4; English price, 17s., net.

THE GAS ENGINE.—By Cecil P. Poole, Editor of "Power and the Engineer," Author of "The Wiring Handbook," etc. New York and London: Hill Publishing Co. Cloth; 6 × 9½ ins.; pp. 97; folding tables and 42 text illustrations. $1, net.

DIE GASMASCHINE.—Ihre Entwickelung, Ihre Heutige Bauart und Ihr Kreisprozess. By R. Schöttler, Professor in the Ducal Technical College at Braunschweig. Fifth edition, revised. Berlin, Germany: Julius Springer. Cloth; 7½ × 10½ ins.; pp. 491; 622 illustrations, mostly in the text. 20 marks; American price, $8.

IMPERIAL EARTHQUAKE INVESTIGATION COMMITTEE (Japan).—Bulletin, Vol. II., No. 3. Tokyo, Japan: The Committee. Stiff paper; 7½ × 10¼ ins.; pp. 215 to 228; folding and other plates.

INTERNAL COMBUSTION ENGINES.—Their Theory, Construction and Operation. By Rolla C. Carpenter and H. Diederichs, Professors of Experimental Engineering, Sibley College, Cornell University. Second edition, revised. New York: D. Van Nostrand Co. Cloth; 6 × 9½ ins.; pp. 597; 379 illustrations in the text. $5, net.

THE JOURNAL OF THE IRON AND STEEL INSTITUTE.—Vol. LXXVIII., No. III., 1908. Edited by L. P. Sidney, Assistant Secretary. London, England: E. & F. N. Spon, Ltd. New York: Spon & Chamberlain. Cloth; 5½ × 8¾ ins.; pp. 738; 38 plates.

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THE LIFE STORY OF SIR CHARLES TILSTON BRIGHT, CIVIL ENGINEER.—With Which Is Incorporated the Story of the Atlantic Cable, and the First Telegraph to India and the Colonies. (Revised and abridged edition.) By Charles Bright, F. R. S. E., Author of "Submarine Telegraphs," etc. London, England: Archibald Constable & Co., Ltd. Cloth; 5½ × 8¾ ins.; pp. 478; numerous illustrations in the text. 12s. 6d., net; American price, $5.

THE MANUFACTURE OF EXPLOSIVES.—Twenty Years' Progress. Four Cantor Lectures Delivered at the Royal Society of Arts in November and December, 1908. By Oscar Guttmann, M. Inst. C. E. London and New York: Whittaker & Co. Cloth; 6 × 9 ins.; pp. [illegible]; nine plates. $1.10, net.

THE "MECHANICAL WORLD" ELECTRICAL POCKET BOOK FOR 1909.—Containing a Collection of Electrical Engineering Notes, Rules, Tables and Data. Manchester, England: Emmott & Co., Ltd. Cloth; 4 × 6¼ ins.; pp. 208; 60 illustrations in the text. 6d., net.

THE MUNICIPAL ECONOMIST.—A Monthly Magazine Devoted to Public Works and Municipal Affairs. Vol. I., No. 2, February, 1909. Chicago, Ill.: The Municipal Information Bureau. Paper; 7¾ × 10½ ins.; pp. 60; illustrated. $5 per year.

NATIONAL FIRE PROTECTION ASSOCIATION.—Index to Subjects Covered in the Printed Records. Chicago, Ill.: The Secretary (382 Ohio St.). Stiff paper; 5¼ × 9 ins.; pp. 47.

THE NEUTRAL LINE.—A Plea for Scientific Regulation of the Tariff. Address to the National Tariff Commission Convention at Indianapolis, Feb. 16-18, 1909. By Henry R. Towne, President Merchants' Association of New York. New York: The Merchants' Association. Paper; 6 × 9 ins.; pp. 32.

NEW JERSEY SANITARY ASSOCIATION.—Proceedings of the Annual Meeting Held Dec. 4-5, 1908, at Lakewood, N. J. (James A. Exton, M. D., Arlington, N. J., Secy.). Trenton, N. J.: Pub. Doc. Stiff paper; 5¾ × 9 ins.; pp. 137.

NEW METHODS IN BACKWATER COMPUTATIONS.—By B. F. Groat, Professor of Mechanics, School of Mines, University of Minnesota. (Reprint from "The Minnesota Engineer," January, 1909, Vol. XVII., No. 2.) Paper; 6¾ × 10 ins.; pp. 15; five illustrations in the text.

A PHILIPPINE SUBSTITUTE FOR LIGNUM VITAE.—By W. I. Hutchinson, Forester. Bulletin No. 9, Bureau of Forestry; Major George P. Ahern, Director. Manila, P. I.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 8.

THE PORT OF PORTLAND COMMISSION.—Biennial Report to the 25th Regular Session of the Legislative Assembly of the State of Oregon, 1907-1908. (J. B. C. Lockwood, M. Am. Soc. C. E., Chief Engineer.) Paper; 6 × 9 ins.; pp. 68; three plates, one folding map and numerous tables.

PROFESSIONAL PAPERS, U. S. GEOLOGICAL SURVEY.—George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 9 × 11½ ins.

No. 61: Glaciation of the Uinta and Wasatch Mountains. By Wallace W. Atwood. Pp. 96; 15 plates (1 in pocket) and 24 text illustrations.

THE PUBLIC UTILITY COMMISSION OF NEW YORK CITY.—From "The City Club Bulletin," Vol. II., No. 21, Jan. 20, 1909. Chicago, Ill.: The City Club (228 South Clark St.). Paper; 6¾ × 10¼ ins.; pp. 235 to 250.

PUBLIC WORKS DEPARTMENT (South Australia).—Report for the Year Ending June 30, 1907. (Thomas Price, Commissioner of Public Works.) Adelaide, South Australia: Pub. Doc. Paper; 8½ × 13¼ ins.; pp. 101; folding and other plates.

THE RAILWAY LOCOMOTIVE.—What It Is and Why It Is What It Is. By Vaughan Pendred, M. Inst. M. E. New York: D. Van Nostrand Co. Cloth; 5½ × 8½ ins.; pp. 310; 94 illustrations in the text. $2, net.

REFUSE AND GARBAGE DISPOSAL.—References to Books and Magazine Articles. (Reprinted from the Monthly Bulletin, January, 1909.) Pittsburg, Pa.: Carnegie Library. Paper; 6 × 9 ins.; pp. 39. 5 cts.

SHIPPING AND OVERSEA MIGRATION.—Commonwealth of Australia, 1907. Published under the Authority of the Minister of Home Affairs, by G. H. Knibbs, Commonwealth Statistician. Melbourne, Australia: Pub. Doc. Stiff paper; 8 × 12¾ ins.; pp. 99.

A SHORT HAND-BOOK OF OIL ANALYSIS.—By Augustus H. Gill, Ph. D., Associate Professor of Technical Analysis at the Massachusetts Institute of Technology, Boston, Mass., Author of "Gas and Fuel Analysis for Engineers," etc. Fifth edition, revised and enlarged. Philadelphia and London: J. B. Lippincott Co. Cloth; 5½ × 8¼ ins.; pp. 179; six illustrations in the text. $2, net.

THE SOCIOLOGIC ASPECTS OF TYPHOID FEVER.—Carroll E. Edson, A. M., M. D. (Proceedings of the Colorado Scientific Society, Vol. IX.) Denver, Colo.: The Society. Paper; 6 × 9½ ins.; pp. 113 + 133; six text illustrations.

STATE BOARD OF IRRIGATION (Nebraska).—Biennial Report of the State Engineer, Secretary to the Governor, 1907-1908. (Adna Dobson, State Engineer, Secy.) Lincoln, Neb.: Pub. Doc. Cloth; 5¾ × 9 ins.; pp. 186; 13 plates.

STATE ENGINEER (Colorado).—Biennial Report to the Governor for the Years 1907-1908. (Thomas W. Jaycox, State Engineer.) Denver, Colo.: Pub. Doc. Paper; 6 × 9 ins.; pp. 281; numerous folding and other plates; maps and bridge drawings in separate pamphlet.

STATE FORESTER (California).—Second Biennial Report. (G. B. Lull, State Forester.) Sacramento, Cal.: Pub. Doc. Paper; 5¾ × 9 ins.; pp 33; folding plates and text illustrations.

STRENGTH OF MATERIALS.—By Arthur Morley, M. Inst. M. E., Professor of Mechanical Engineering in University College, Nottingham. London, New York and Bombay: Longmans, Green & Co. Cloth; 5½ × 8¼ ins.; pp. 487; 244 illustrations in the text. $2.50, net; English price, 7s. 6d., net.

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